652

# PS-X600

*US Model*
*Canadian Model*
*AEP Model*
*UK Model*
*E Model*

## STEREO TURNTABLE SYSTEM

### SPECIFICATIONS

**Turntable**

| | |
|---|---|
| Platter | 32 cm (12⅝ in.), aluminum-alloy diecast |
| Motor | Linear BSL (brushless and slotless) motor |
| Drive system | Direct drive |
| Control system | Quartz lock control, magnedisc servo control system |
| Speed | 33⅓ rpm, 45 rpm |
| Starting characteristics | Comes to nominal speed within a half revolution (33⅓ rpm) |
| Wow and flutter | 0.015 (WRMS)* 0.025% (WRMS) ±0.03% (DIN) |
| Signal-to-noise ratio | 78 dB (DIN-B) |
| Load characteristics | 0% up to 150 g stylus force (at lead-in groove of a record) |
| Speed deviation | Within ±0.003% |
| Automatic system | Lead-in, return, reject, repeat, record size selection, anti-skating |

**Tonearm**

| | |
|---|---|
| Type | Electronic tonearm |
| Pivot-to-stylus length | 216.5 mm (8⅝ in.) |
| Overall arm length | 295 mm (11⅝ in.) |
| Overhang | 16.5 mm (21/32 in.) |
| Tracking error | +3°, −1° |
| Stylus force adjustment range | 0 - 3 g |
| Cartridge shell weight | 5 g |
| Cartridge weight range (including supplied cartridge shell) | 7.5 - 12.5 g<br>12 - 17 g (with extra weight) |

— Continued on page 2 —

SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY SHADING AND MARK ⚠ ON THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.

ATTENTION AU COMPOSANT AYANT RAPPORT À LA SÉCURITÉ!

LES COMPOSANTS IDENTIFIÉS PAR UNE TRAME ET UNE MARQUE ⚠ SUR LES DIAGRAMMES SCHÉMATIQUES, LES VUES EXPLOSÉES ET LA LISTE DES PIÈCES SONT CRITIQUES POUR LA SÉCURITÉ DE FONCTIONNEMENT. NE REMPLACER CES COMPOSANTS QUE PAR DES PIÈCES SONY DONT LES NUMÉROS SONT DONNÉS DANS CE MANUEL OU DANS LES SUPPLÉMENTS PUBLIÉS PAR SONY.

MICROFILM

SONY®
SERVICE MANUAL

**General**

| | | |
|---|---|---|
| Power requirements | US, Canadian Model: | 120 V ac, 60 Hz |
| | AEP Model: | 220 V ac, 50/60 Hz |
| | UK Model: | 240 V ac, 50/60 Hz |
| | E Model: | 110–120 or 220–240 V ac adjustable 50/60 Hz |
| Power consumption | 16 W | |
| Dimensions | Approx. 430 × 120 × 385 mm (w/h/d) (17 × 4¾ × 15¼ in.) including projecting parts and controls | |
| Weight | Approx. 8.5 kg (18 lbs 12 oz), net | |
| | Approx. 10 kg (22 lbs 1 oz), in shipping carton | |

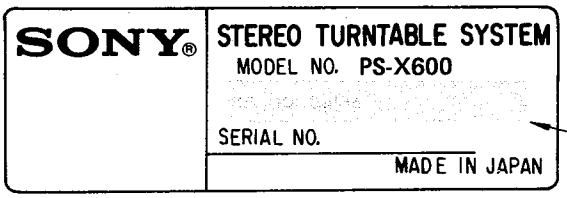
**Cartridge (AEP, E model)**

| | |
|---|---|
| Type | Moving-magnet |
| Frequency response | 10 – 30,000 Hz |
| Channel separation | 25 dB at 1 kHz |
| Output voltage | 3 mV at 1 kHz, 5 cm/sec, 45° |
| Load impedance | 50 kΩ – 100 kΩ |
| Tracking force | 1.0 – 2.0 g (1.5 g recommended) |
| Stylus | Sony ND-200E |
| Weight | 3.4 g |

* This new measuring method concerns only the turntable assembly, including the platter. It excludes wow and flutter caused by the tonearm, the cartridge, or the record. Measured by obtaining signal from magnetic pickup head.

## MODEL IDENTIFICATION

*– Specification Label –*




**US, Canadian model:**
**AC 120 V 60 Hz 16 W**

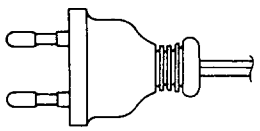
**AEP model:**
**AC 220 V ~ 50/60 Hz 16 W**

**UK model:**
**AC 240 V ~ 50/60 Hz 16 W**

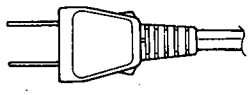
**E model:**
**AC 110 – 120, 220 – 240 V ~ 50/60 Hz 16 W**

**– Power Cord –**

**$E_1$ model: euro-plug 1-555-734-21**



**$E_2$ model: parallel-blade plug 1-551-473-31**



## SERVICING NOTES

### Handling Precautions for MOS ICs

Generally, the insulation resistance of the oxide layer in MOS IC structures is very high, and the oxide layer is very thin. Because of this, it is possible that the static voltages usually present on clothes and the human body will be enough to generate a potential difference across the insulator, high enough to cause a breakdown of the insulating layer.

The following precautions should be taken while handling these ICs.

(Particular care should be taken under conditions of low humidity.)

**Precautions in Replacing MOS ICs**

1. Store new ICs by inserting them into a urethane-polyester cushion (which is somewhat conductive), or wrapping it in aluminum foil, so that all the pins are at the same potential.
   (The ICs should be stored in that manner until mounted on the circuit board.)

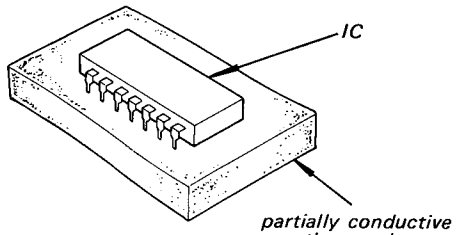



Fig. A

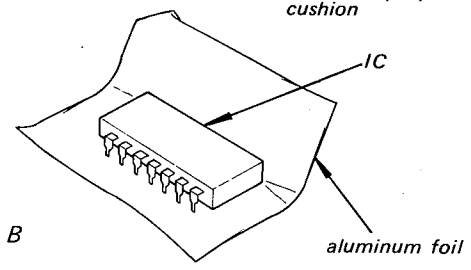



Fig. B

2. Check the soldering iron for possible power-line leakage current. Make sure that there is no leakage path by connecting an ohmmeter to the tip of the soldering iron and the plug as shown in Fig. C. If there is a leakage path, use some other soldering iron.

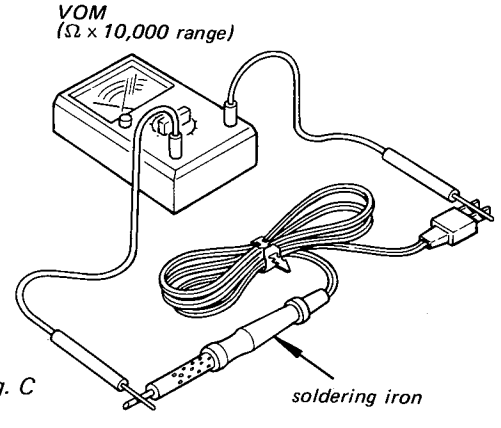



Fig. C

3. Equalize any potential difference between the clothes, the tools in use, the work bench, the set being worked on, and the packaged IC by touching them all in succession with the hands or a conductive wire or tool.
4. The following are effective methods for handling ICs that remove the potential difference across the oxide layer.
   - Use a paper clip modified by soldering in a wire braid insert.

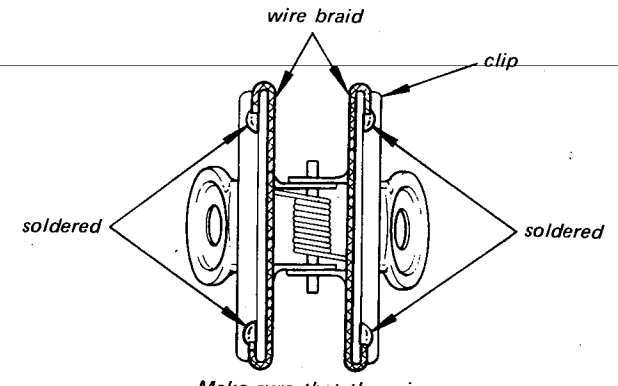



Fig. D

Make sure that there is no solder on the inside.

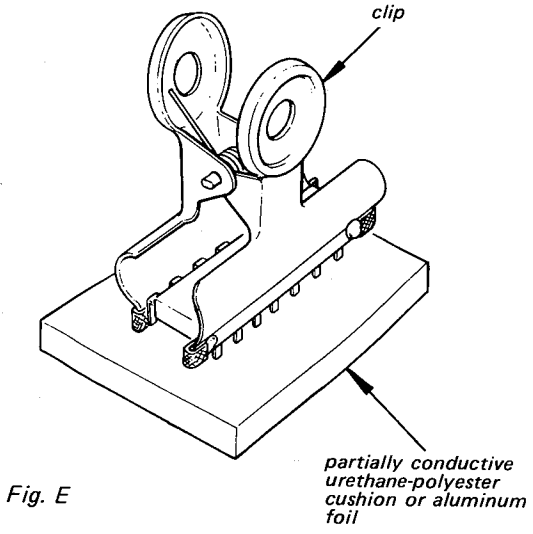



Fig. E

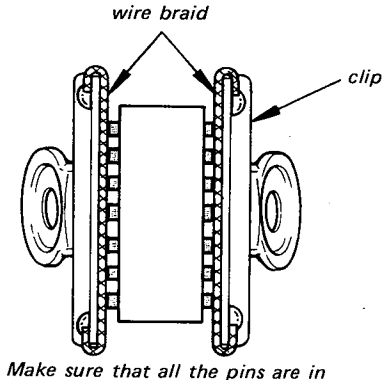



Fig. F

Make sure that all the pins are in contact with the wire braid (all the pins will then be at the same potential.).

- Take a short length of fine bare wire and wind it around the IC so that it shorts all the pins of the IC, while it is still in the urethane-polyester cushion or aluminum foil. This ensures that all the pins are at the same potential.

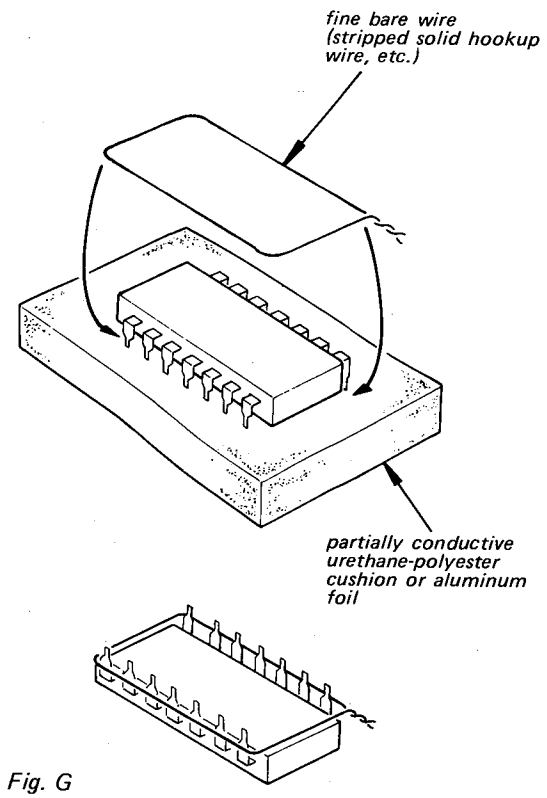



Fig. G

- When it is necessary to handle the IC with the fingers, do not touch any pin, and hold the IC at the ends of its plastic-package case as shown in Fig. H.

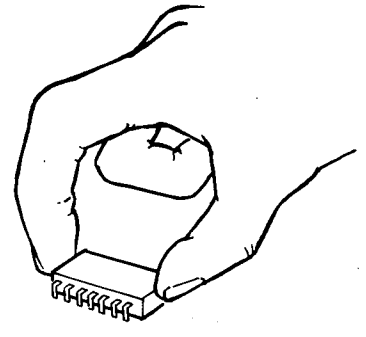


Fig. H

5. Method of Mounting
   Insert the IC while holding it with the modified clip, and solder all the pins with the clip still shorting the pins. (Similarly, solder all the pins while the bare shorting wire is still wound around them.). Remove the clip or the bare shorting wire only after all the pins have been soldered.

**Precaution while Checking C-MOS ICs**

The C-MOS ICs (Complementary MOS) are MOS ICs that have their output sections made up of N-channel and P-channel push-pull stages to increase their speed of operation. If the output terminal of these ICs comes into contact with B+ or B– voltage, then the FET which is ON at that time will either become shorted or open.

This is valid for all the output sections that are connected together by the interconnections. Even the circuits that are physically separated (and not on the same board) can be destroyed simultaneously.

**Example:**

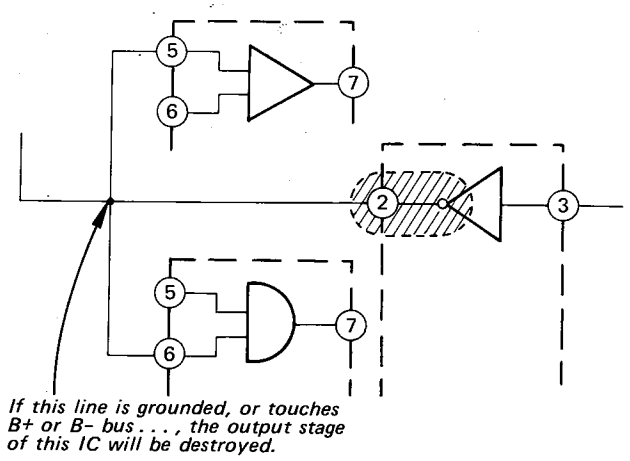
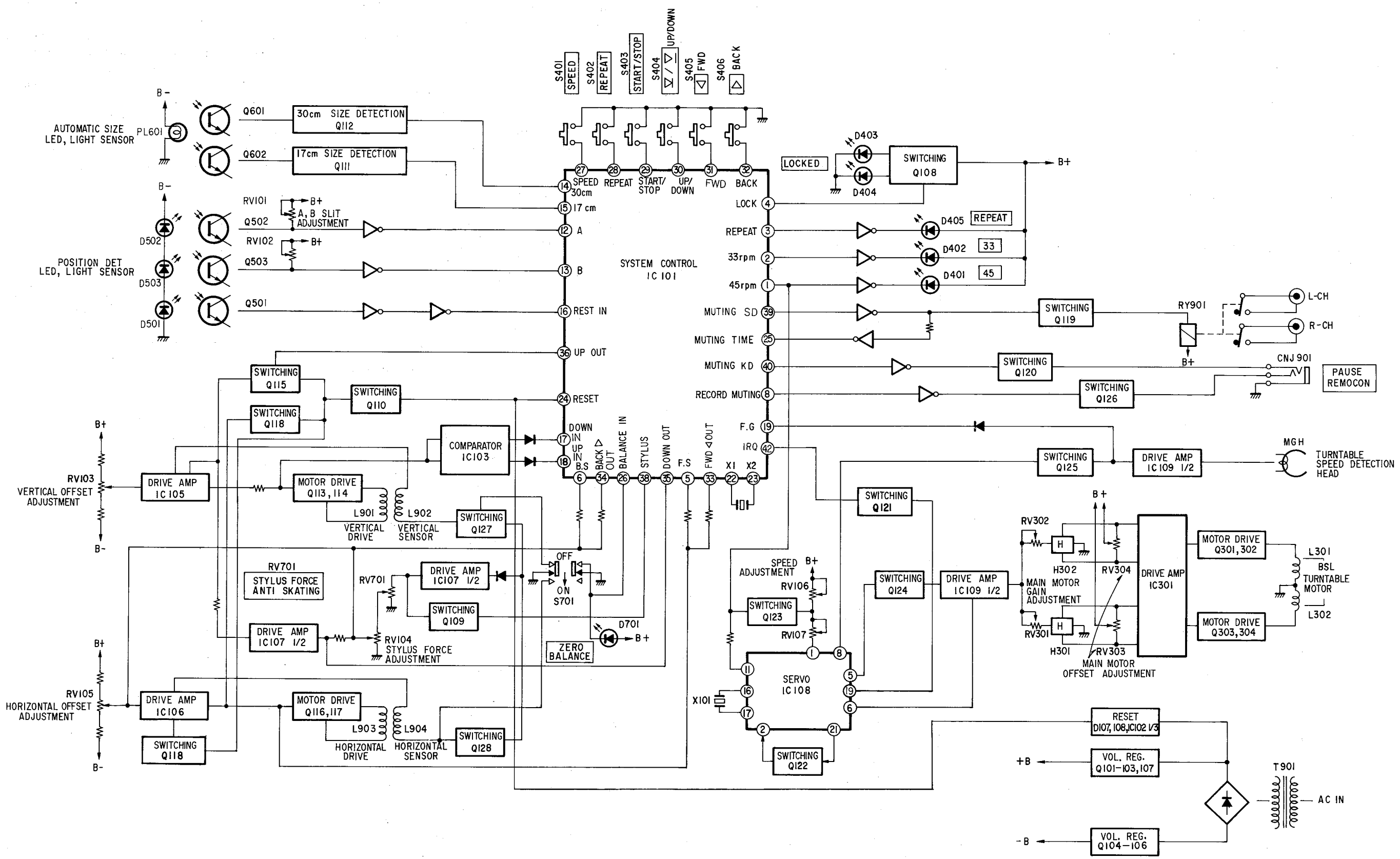



Fig. I

# SECTION 1
# OUTLINE

## 1-1. BLOCK DIAGRAM



## 1-2. CIRCUIT DESCRIPTION

### 1. When the POWER Switch is Turned on (See Fig. 1):

The waveform shaper, consisting of IC102, turns the voltage at terminal (24) of IC101 to low level "0" in half a second when C109 is charged with B+ power. As a result, IC101 is reset.

This means the microprocessor (IC101) does not operate for 0.5 seconds after the power switch is turned on.

Also, buttons can be effectively pressed after it is assured that the tonearm has been on the arm rest for about 0.5 seconds.

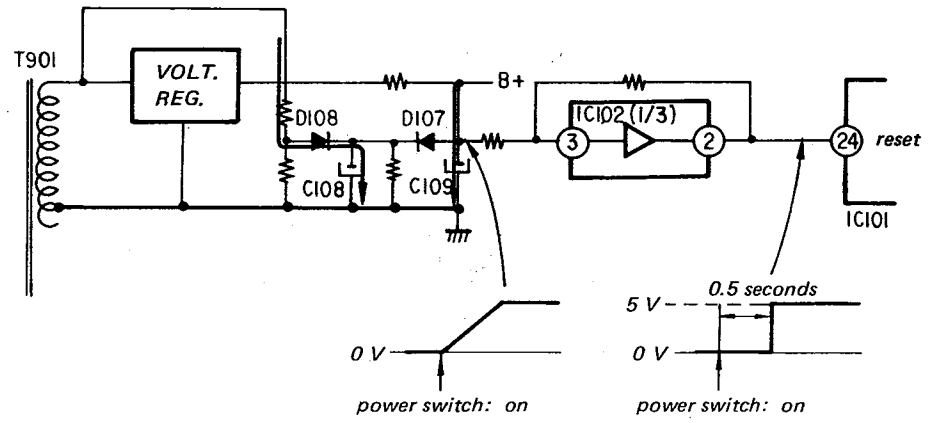



*Fig. 1*

### 2. Circuit for Tonearm's Horizontal Movement (See Fig. 2):

**[◁ : FWD]**

When S405 (◁ : FWD) is depressed, the voltage at terminal (33) of IC101 becomes high "1". This swings the voltage at terminal (3) of IC106 positive and the output of the terminal (1) goes positive. This turns Q116 on and current passes through L903 (lifter drive coil) in direction "A", thus moving the tonearm forward.

**[▷ : BACK]**

When S406 (▷ : BACK) is depressed, the voltage at terminal (34) of IC101 becomes high "1". A negative voltage appears at terminal (1) of IC106 turning Q117 on. Since Q117 is on, current passes through L903 in direction "B", thus moving the tonearm backwards.

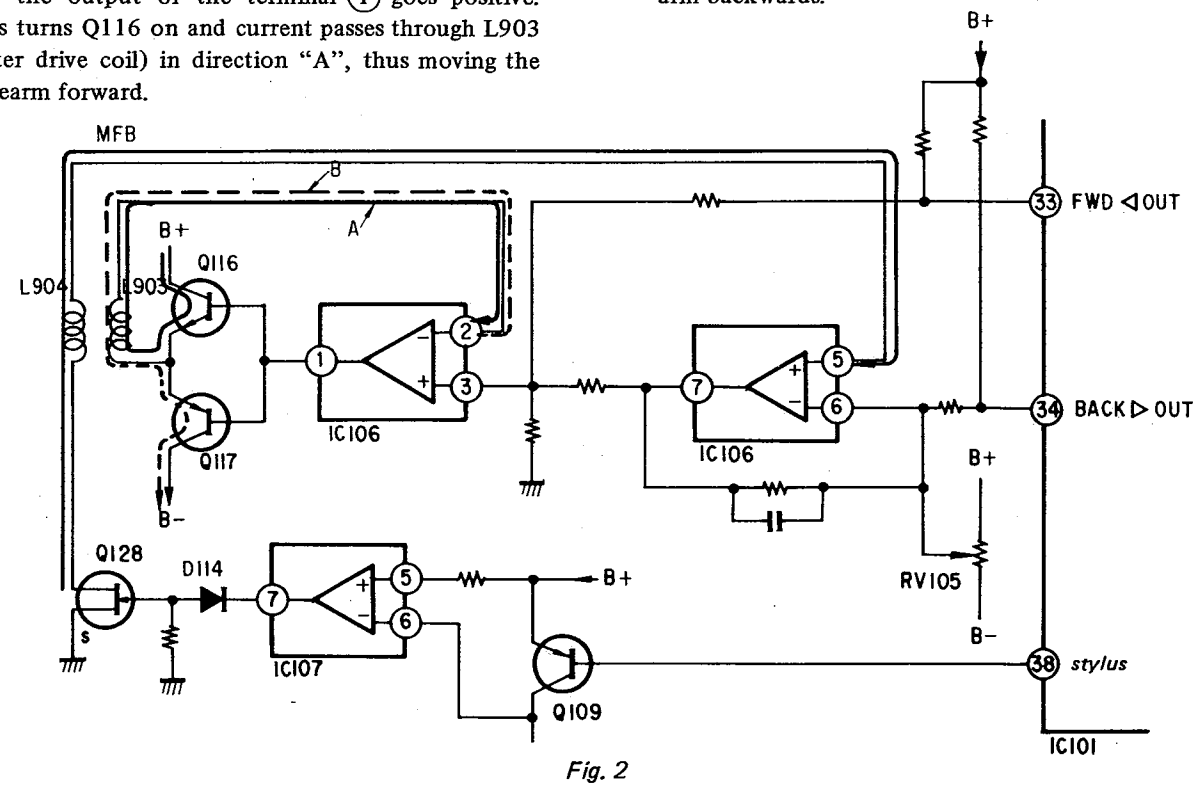



*Fig. 2*



### 3. Tonearm Lifting Circuit (See Fig. 3):

Turning the power switch on raises the arm lifter.

**[▽ : UP]**

When the power switch is turned on or when S404 is depressed with the tonearm at DOWN position, the voltage at terminal (36) of IC101 becomes high "1". A positive voltage appears at terminal (1) of IC105. Then Q113 is on and current passes through L901 (vertical drive coil) in direction "A" thus raising the arm lifter.

**[▽ : DOWN]**

When S404 is depressed with the tonearm at "UP" position, the voltage at terminal (36) becomes low "0" and the voltage at terminal (35) becomes high "1" and becomes low "0" when the tip of the stylus touches the disk. This turns the voltage at terminal (1) of IC105 negative and Q114 is on and current passes through L901 in direction "B" thus lowering the arm lifter.

The voltage at terminal (38) of IC101 becomes low "0", turning Q109 on and B+ voltage from the collector of Q109 is applied to terminal (2) of IC107 via RV701 and RV104. Then the voltage at terminal (1) of IC107 becomes low "0" and a negative voltage appears at terminal (1) of IC105. Thus Q114 turns on and current passes through L901 in direction "B" applying a stylus force.

IC103 compares signals from L902 (vertical sensor coil) to input information into IC101 whether the tip of stylus finishes lowering or rising.

Owing to L902, high level "1" is applied to terminals (2), (5) of IC103 when the stylus finishes lowering and low level "0" is applied when it finishes rising.

Owing to D109, 110 high level "1" is applied to terminal (17) when stylus is lowering and so to terminal (18) when stylus is rising. IC101 makes command of applying stylus force or stopping it, muting on or off.

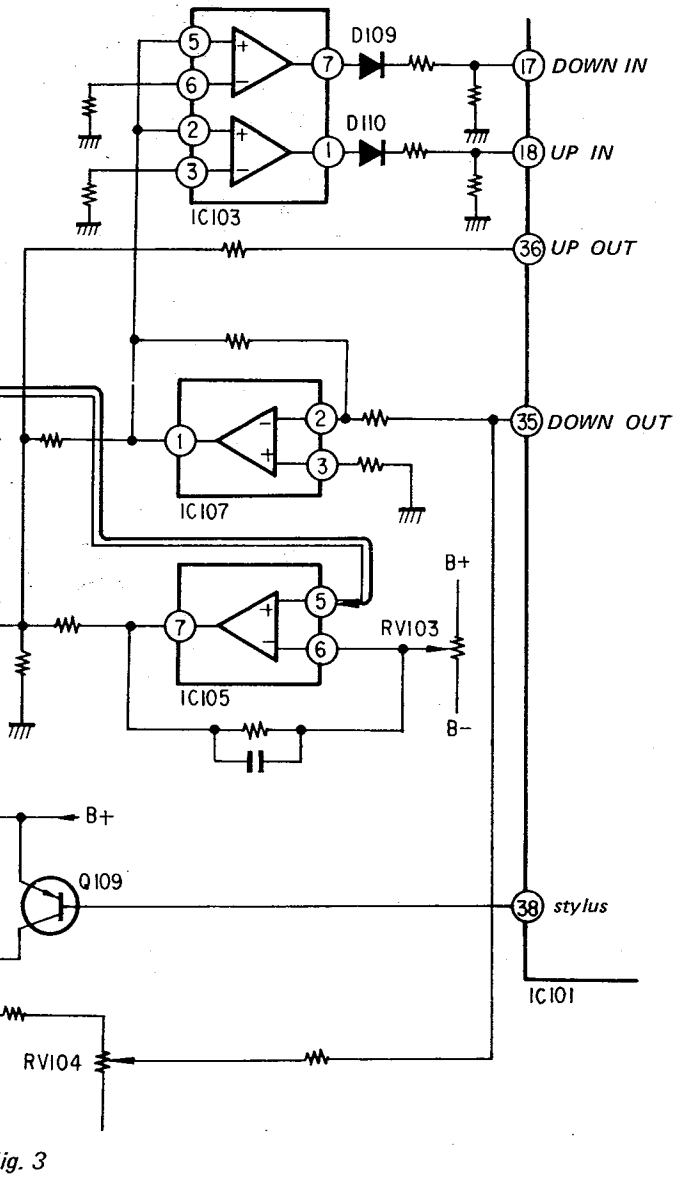



*Fig. 3*



### 4. Automatic D

As long as
from PL601 pa
and switches ph

The outputs
(15) of IC101 t
the disk size.

| IC101 |
|---|
| No disk |
| 17 cm |
| 30 cm |

### Drop-point and

When S403
tonearm moves

The presenc
determined by
rotating with th

The end of
slits of the mov
the tonearm ret

Slits are cou
by D502 and
If the light fro
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are fed to the
where the wavef
are applied to te

Also, wheth
or backward is
of the signals fr

### 3. Tonearm Lifting Circuit (See Fig. 3):

Turning the power switch on raises the arm lifter.

**[ ▽ : UP]**

When the power switch is turned on or when S404 is depressed with the tonearm at DOWN position, the voltage at terminal ㊱ of IC101 becomes high "1". A positive voltage appears at terminal ① of IC105. Then Q113 is on and current passes through L901 (vertical drive coil) in direction "A" thus raising the arm lifter.

**[ ▽ : DOWN]**

When S404 is depressed with the tonearm at "UP" position, the voltage at terminal ㊱ becomes low "0" and the voltage at terminal ㉟ becomes high "1" and becomes low "0" when the tip of the stylus touches the disk. This turns the voltage at terminal ① of IC105 negative and Q114 is on and current passes through L901 in direction "B" thus lowering the arm lifter.

The voltage at terminal ㊳ of IC101 becomes low "0", turning Q109 on and B+ voltage from the collector of Q109 is applied to terminal ② of IC107 via RV701 and RV104. Then the voltage at terminal ① of IC107 becomes low "0" and a negative voltage appears at terminal ① of IC105. Thus Q114 turns on and current passes through L901 in direction "B" applying a stylus force.

IC103 compares signals from L902 (vertical sensor coil) to input information into IC101 whether the tip of stylus finishes lowering or rising.

Owing to L902, high level "1" is applied to terminals ②, ⑤ of IC103 when the stylus finishes lowering and low level "0" is applied when it finishes rising.

Owing to D109, 110 high level "1" is applied to terminal ⑰ when stylus is lowering and so to terminal ⑱ when stylus is rising. IC101 makes command of applying stylus force or stopping it, muting on or off.

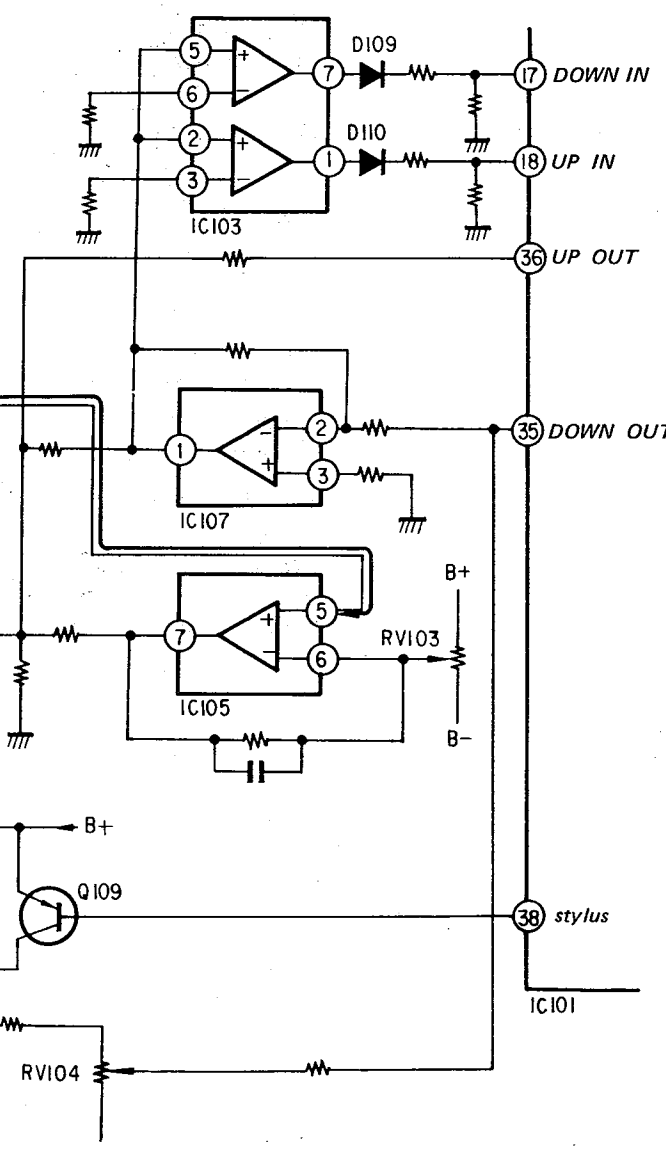



Fig. 3



### 4. Automatic Disk Size Detector (See Fig. 4):

As long as the turntable is rotating, the light from PL601 passes through the prism on the frame and switches phototransistors Q601, 602.

The outputs of Q601, 602 are fed to terminal ⑭, ⑮ of IC101 to be used for automatic detection of the disk size.

| IC101 | terminal ⑭ | terminal ⑮ |
|---|---|---|
| No disk | Signal occurs. | Signal occurs. |
| 17 cm | Signal occurs. | 0 V |
| 30 cm | 0 V | 0 V |

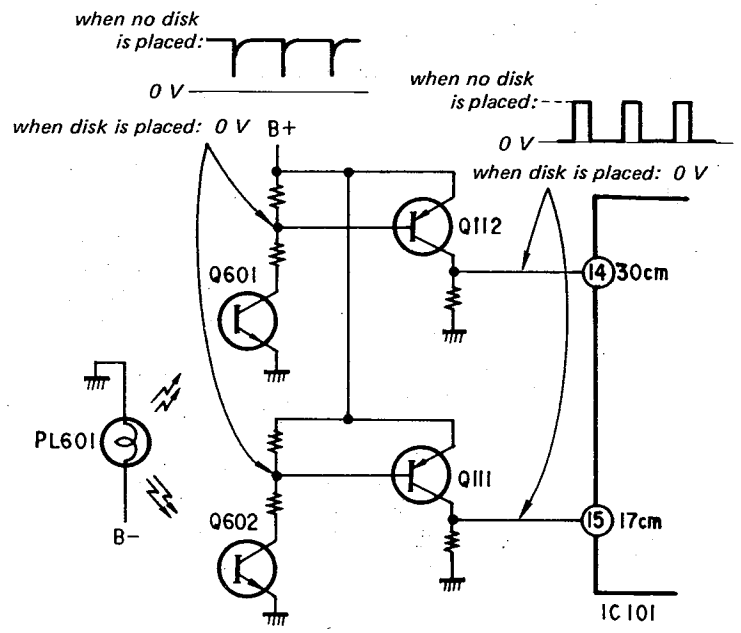



Fig. 4

### Drop-point and End Detection (See Figs. 5 and 6):

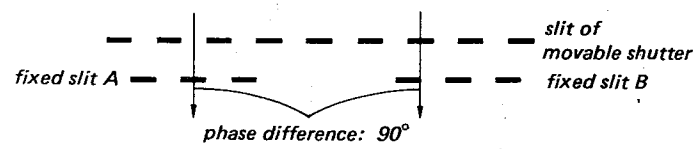
When S403 (START/STOP) is turned on, the tonearm moves toward the disk.

The presence of a drop-point on the disk is determined by counting slits of the movable shutter rotating with the tonearm.

The end of a disk is also detected by counting slits of the movable shutter. After detecting the end, the tonearm returns.

Slits are counted as follows. The light emitted by D502 and D503 strike on the movable shutter. If the light from D502 (D503) passes a slit, it turns on Q502 (Q503). The outputs of Q502 and Q503 are fed to the Schmitt circuit consisting of IC102, where the waveforms are shaped. The shaped outputs are applied to terminals ⑫ and ⑬ of IC101.

Also, whether the tonearm is moving forward or backward is determined by comparing the phases of the signals from terminals ⑫ and ⑬ of IC101.



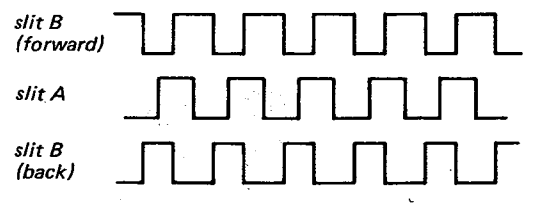




Fig. 5

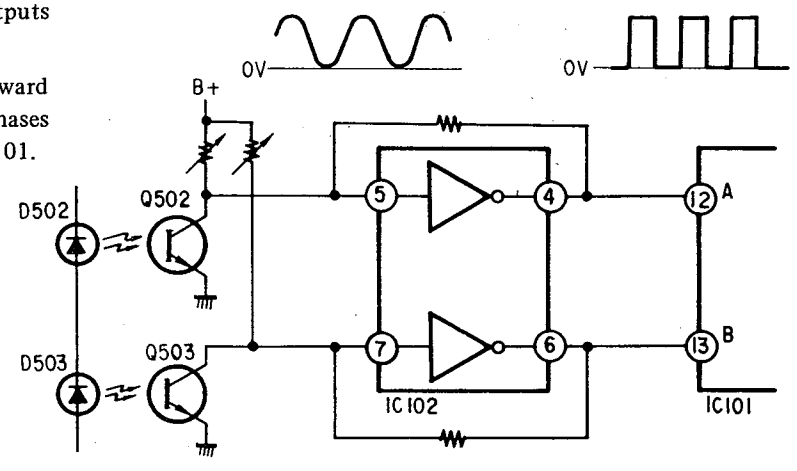


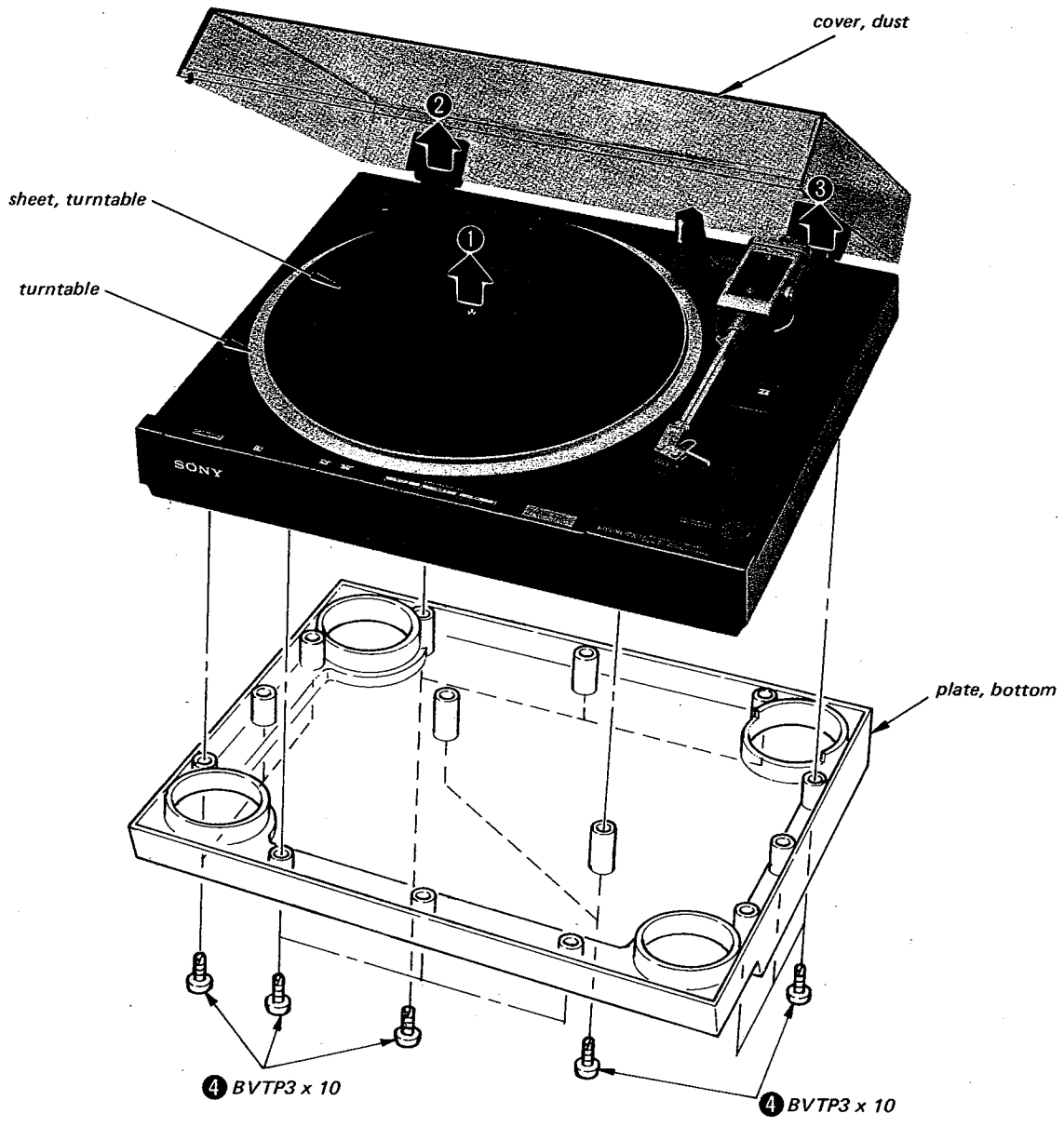

Fig. 6

PS-X600 PS-X600

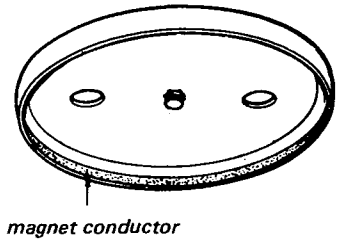
# SECTION 2
# DISASSEMBLY

**Note:** Follow the disassembly procedure in the numerical order given.

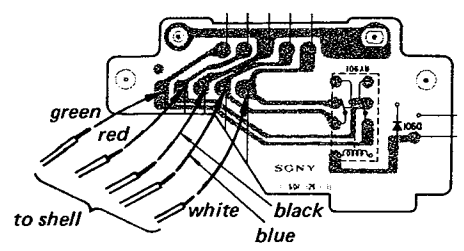
**Turntable/Dust Cover/Bottom Plate**

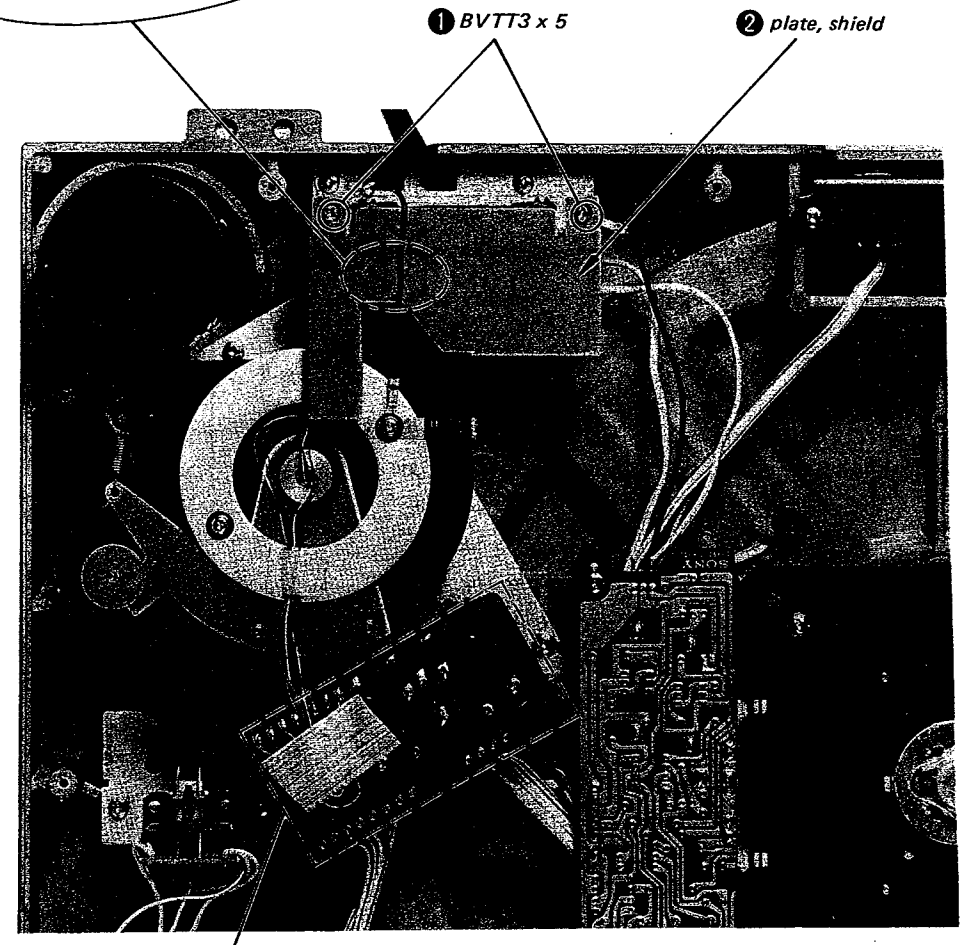


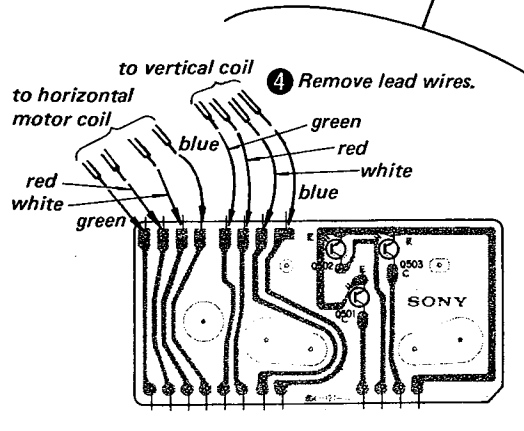

*Note: Be sure not to scratch the magnetic conductor coated on the inside wall of the turntable.*



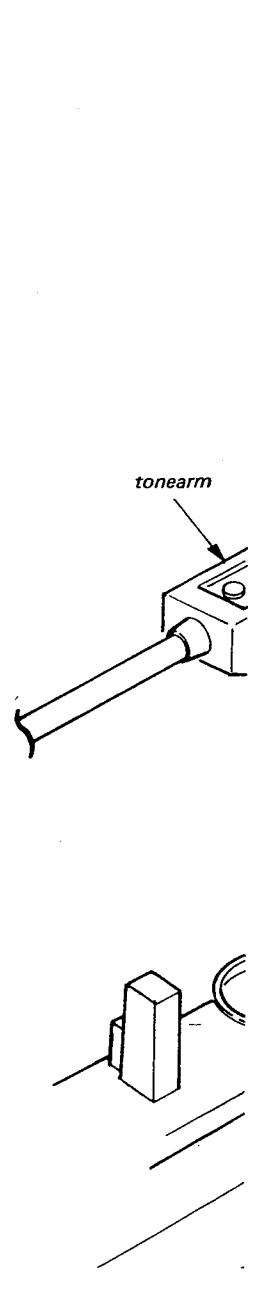

**Tonearm**



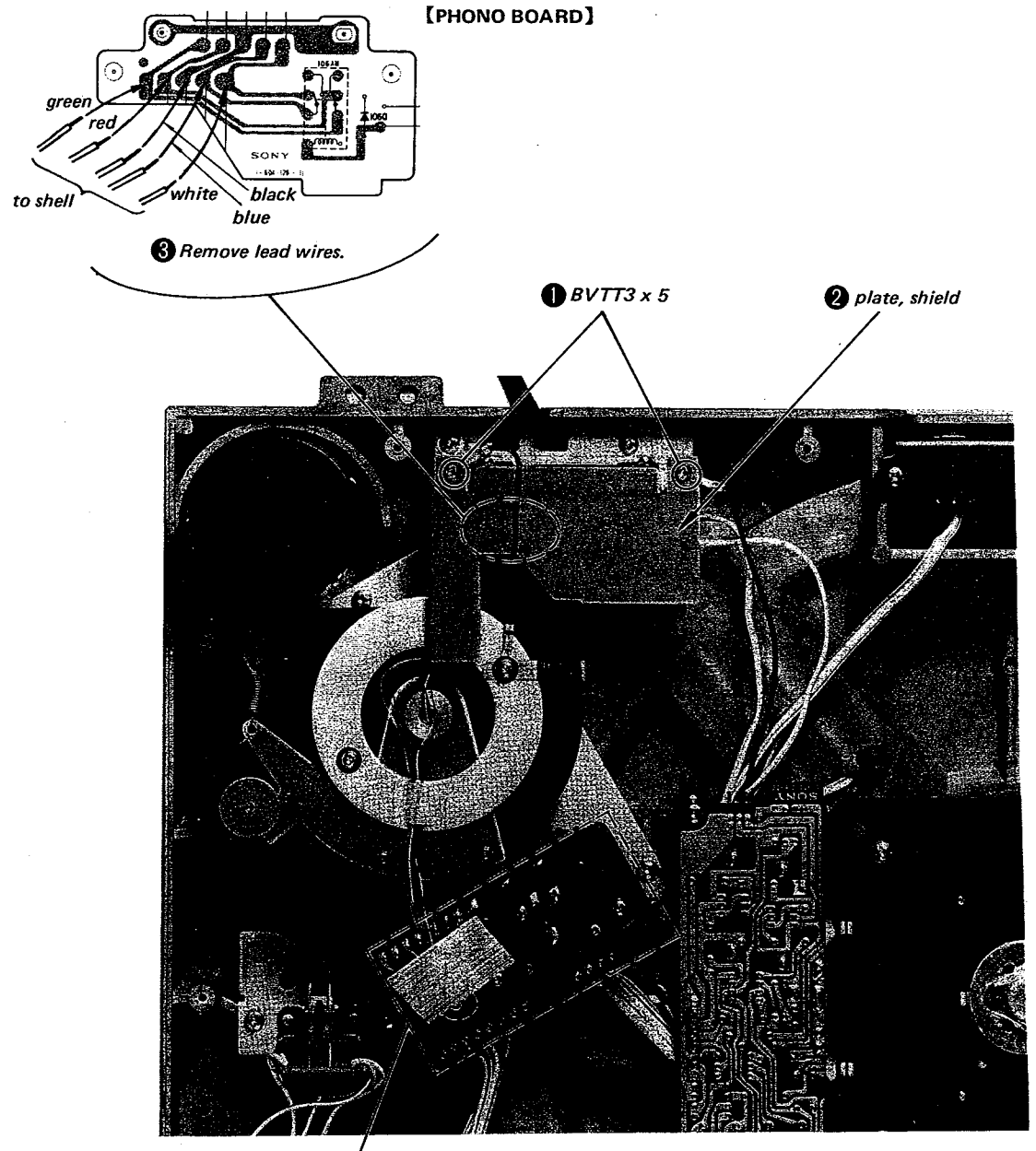



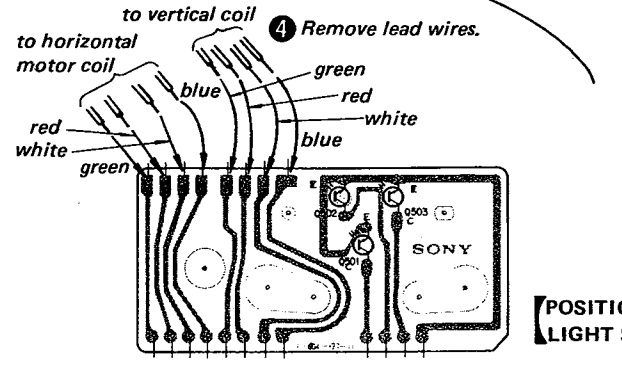



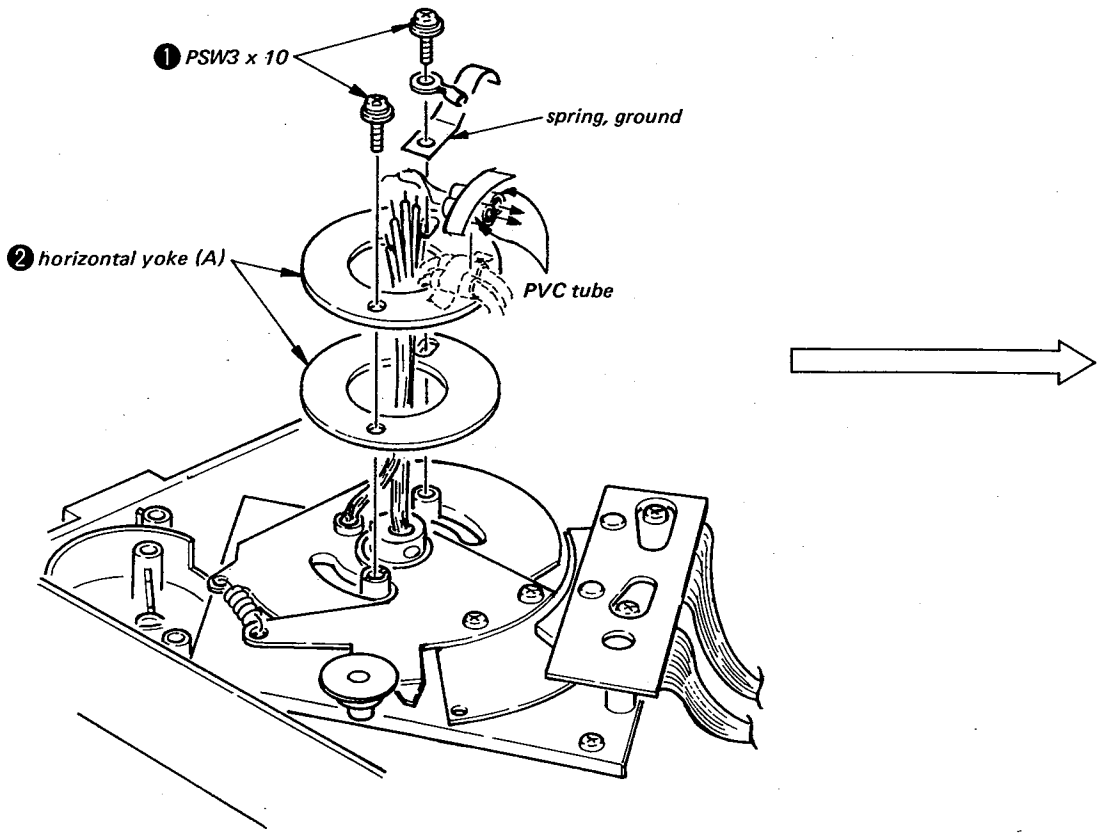

【POSITION-DETECTION LIGHT SENSOR BOARD】

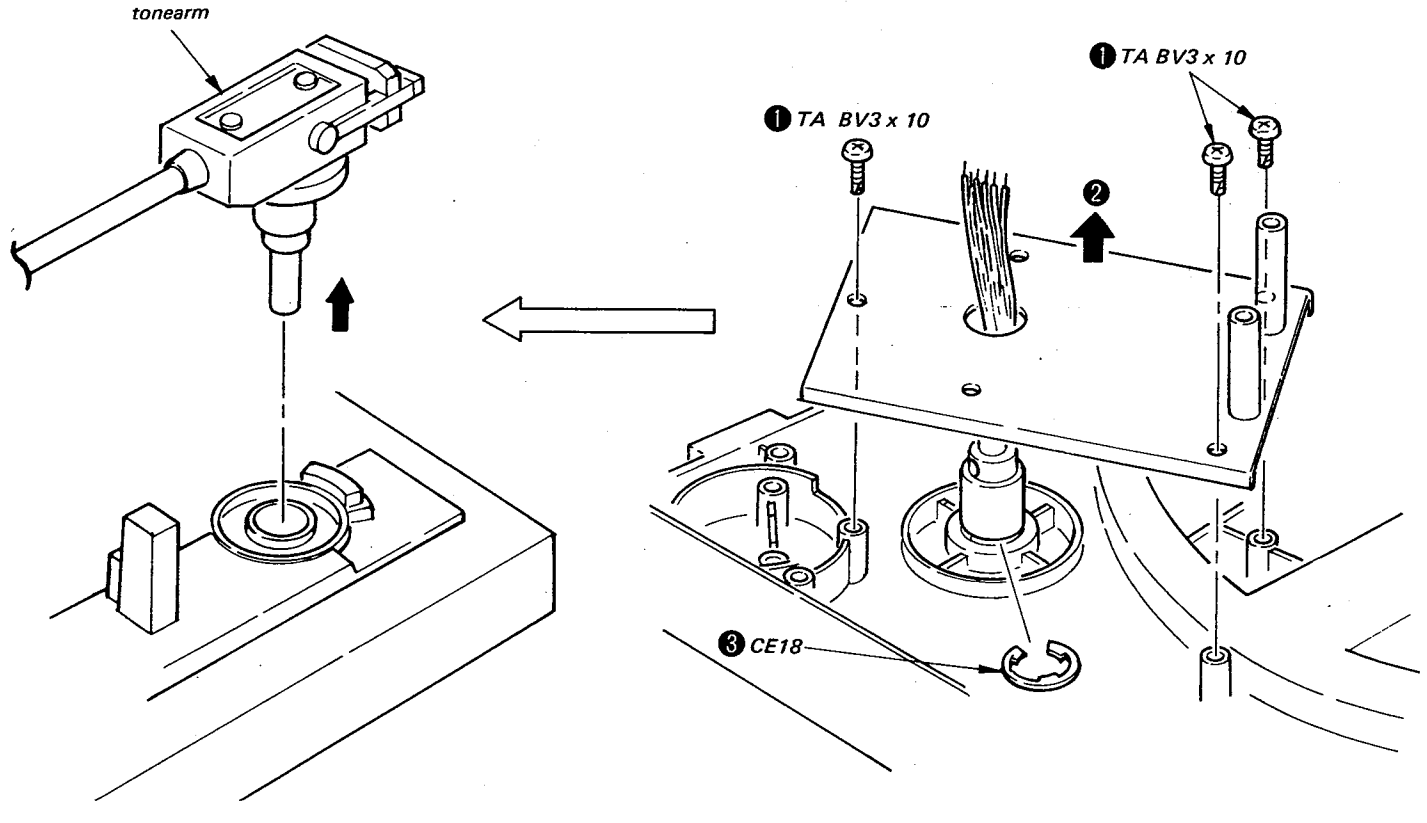


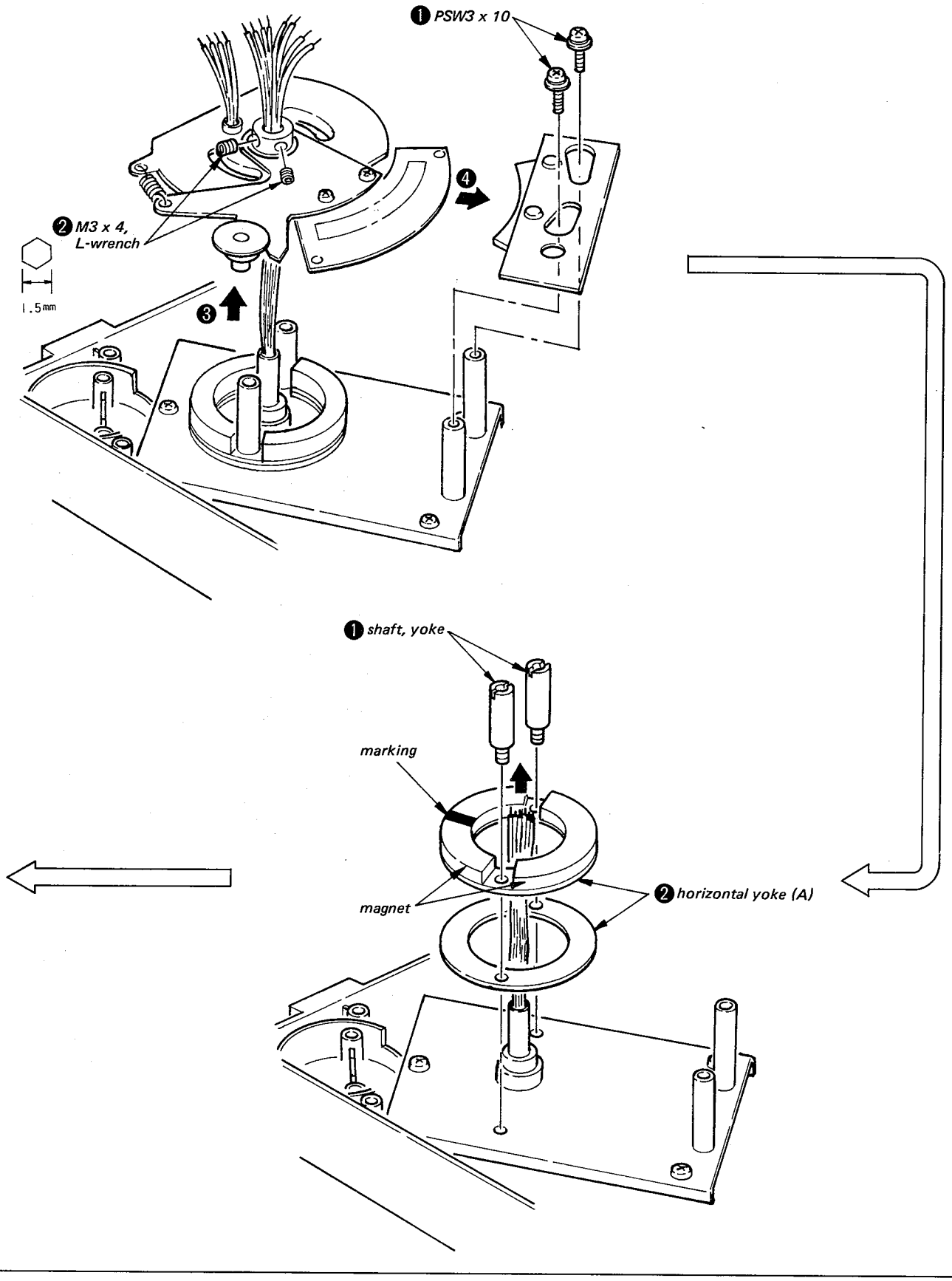
## Tonearm


【PHONO BOARD】
green
red
to shell
white
black
blue
❸ Remove lead wires.
❶ BVTT3 x 5
❷ plate, shield


to vertical coil
❹ Remove lead wires.
to horizontal motor coil
blue
green
red
white
blue
red
white
green
SONY
【POSITION-DETECTION LIGHT SENSOR BOARD】


❶ PSW3 x 10
spring, ground
❷ horizontal yoke (A)
PVC tube


tonearm
❶ TA BV3 x 10
❶ TA BV3 x 10
❷
❸ CE18

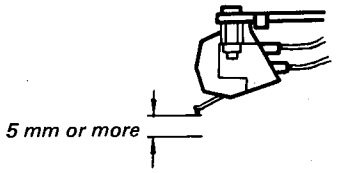

1 PSW3 x 10
2 M3 x 4, L-wrench
1.5mm
3
4
1 shaft, yoke
marking
magnet
2 horizontal yoke (A)

# SECTION 3
# ADJUSTMENTS

## 3-1. MECHANICAL ADJUSTMENTS

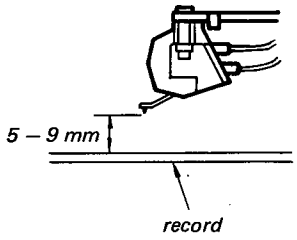
### Vertical-sensitivity Adjustment

1. Perform the longitudinal adjustment.
2. Adjust the pivot bearings and the pivot-locking nuts so that the tonearm sinks more than 5 mm (7/32 inches) when the 40 mg weight is placed on the head shell, and the tonearm is in a horizontally balanced position when the weight is removed.

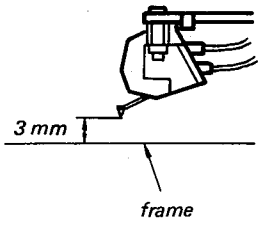


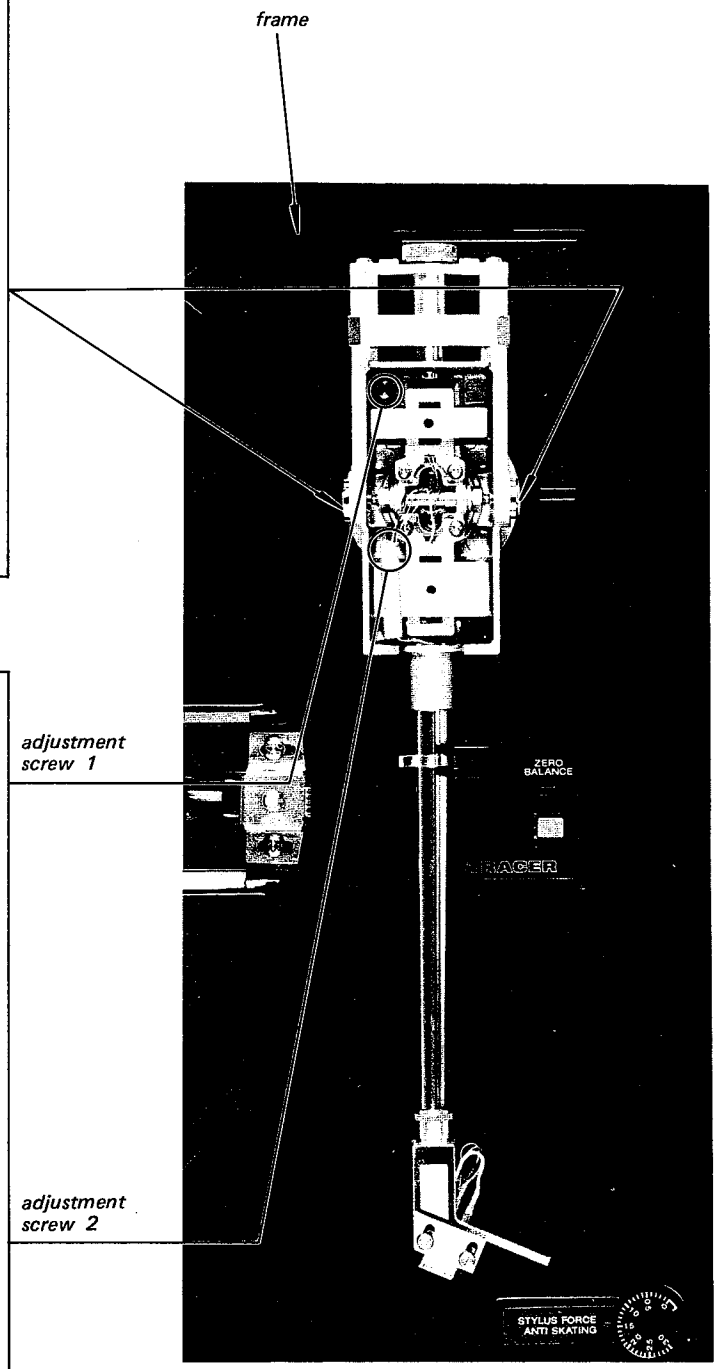

### Stylus Height Adjustment

1. Bring the tonearm above the record. Lift the cueing lever up and adjust the adjustment screw 1 so that the clearance between the stylus tip and the record is 5 – 9 mm (7/32 – 3/8").

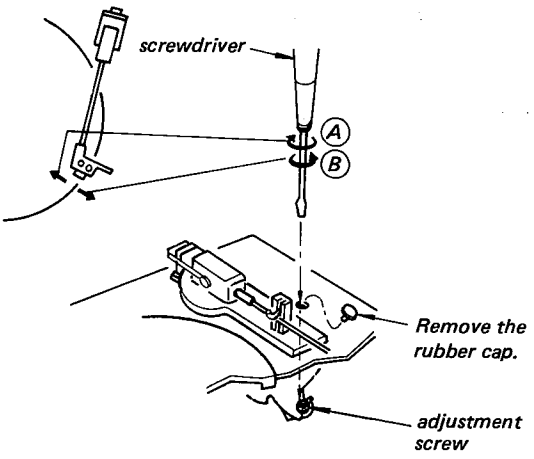



2. Lower the tonearm by pressing UP/DOWN button and adjust the adjustment screw 2 so that the clearance between the stylus tip and the frame is 3 mm (1/8").



## Stylus Drop-point Adjustment




1. Set the record size selector lever to the 30 (12") position and make sure that the stylus drops on the specified point of the test record.

   test record: YFSC-16

| Record size selector lever position | Count of drop-point |
|---|---|
| 30 (12") | 4 to 16 |
| 25 (10") | 6 to 24 |
| 17 ( 7") | 7 to 25 |

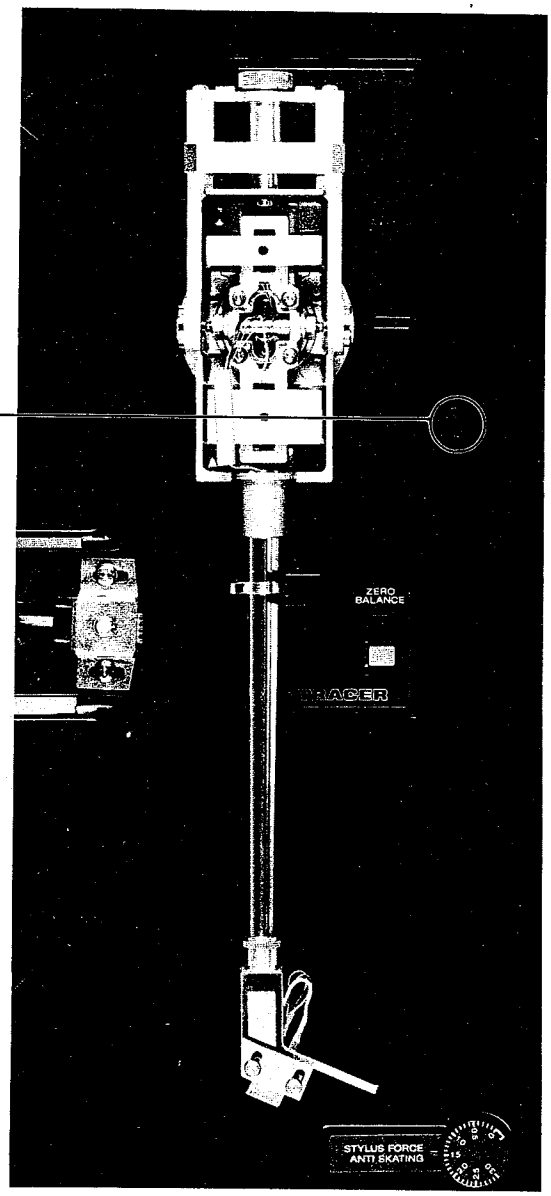
2. If necessary, insert the screwdriver into the hole and adjust the drop-point by turning the adjustment screw.

   To change the drop-point inward:
   Turn the adjustment screw slightly clockwise (A) .

   To change the drop-point outward:
   Turn the adjustment screw slightly counterclockwise (B) .

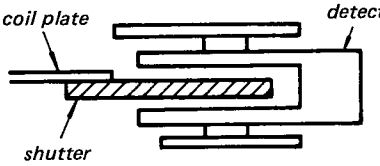
3. Once it is properly adjusted with a 30 cm (12") record, the drop-point will be correct for both 17 cm (7") and 25 cm (10") records.

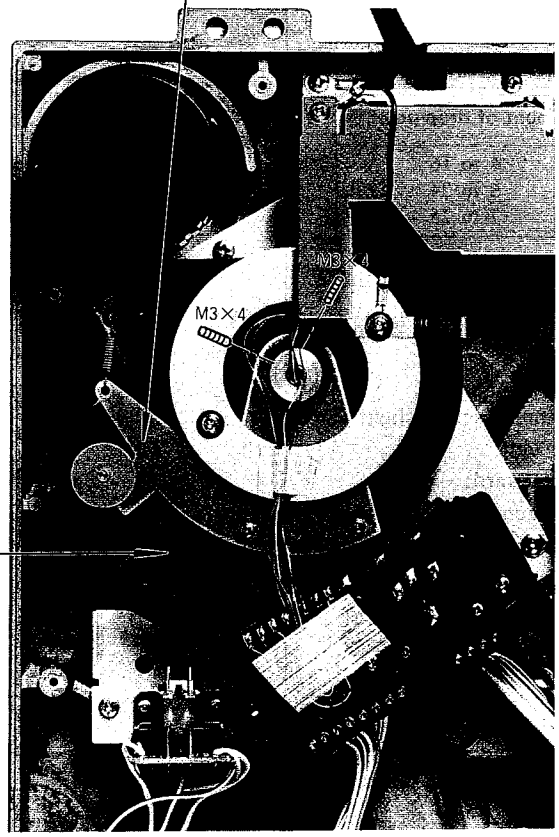
   **Note:** The stylus drop-point changes about 12 mm (½") by one turn of the adjustment screw.



**Coil Plate Position Adjustment**

1. Adjust the coil plate position so that the movable shutter does not touch the detection part when the arm pipe is moved horizontally.

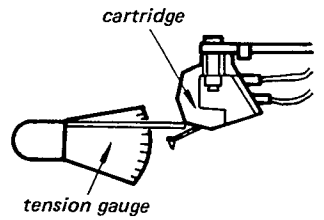


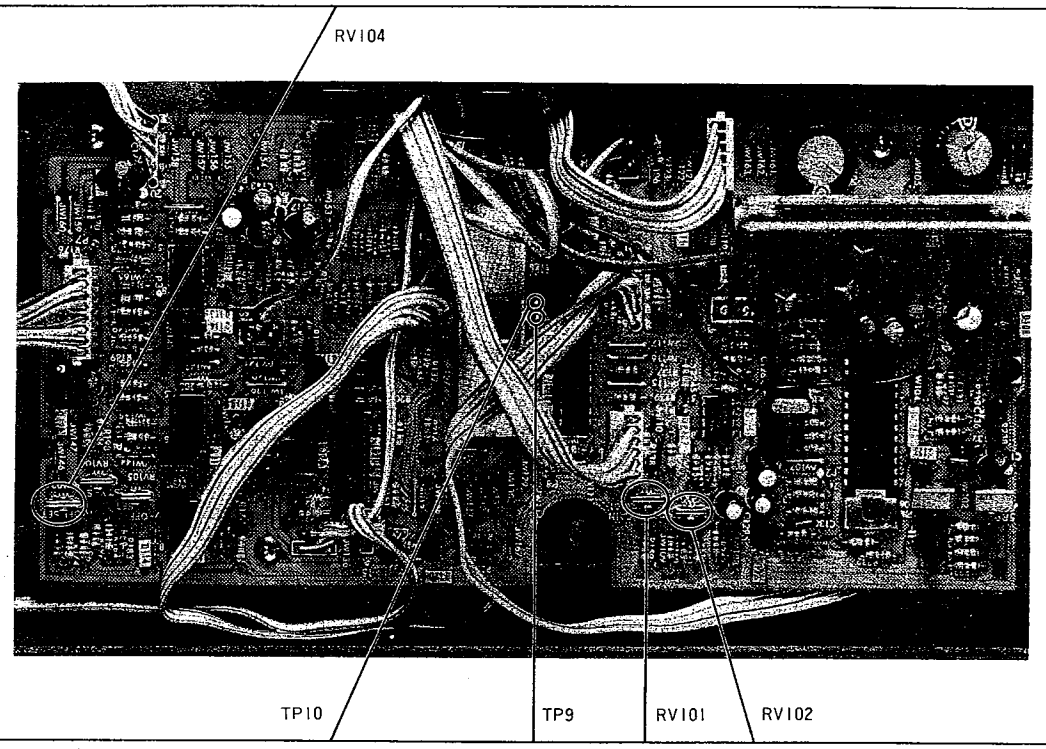



## 3-2. ELECTRICAL ADJUSTMENTS

### Stylus Force Adjustment

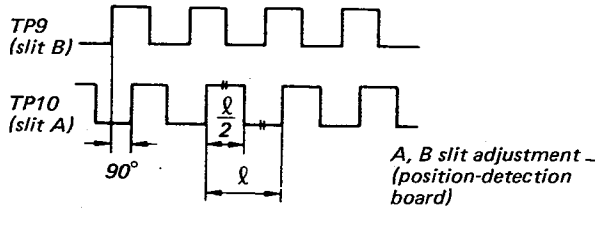
1. Set the STYLUS FORCE control to 1.5 g.
2. Adjust RV104 so that the tension gauge reads 1.5 g.
3. Set the STYLUS FORCE control to 3 g. Confirm that the tension gauge indicates 3 g.

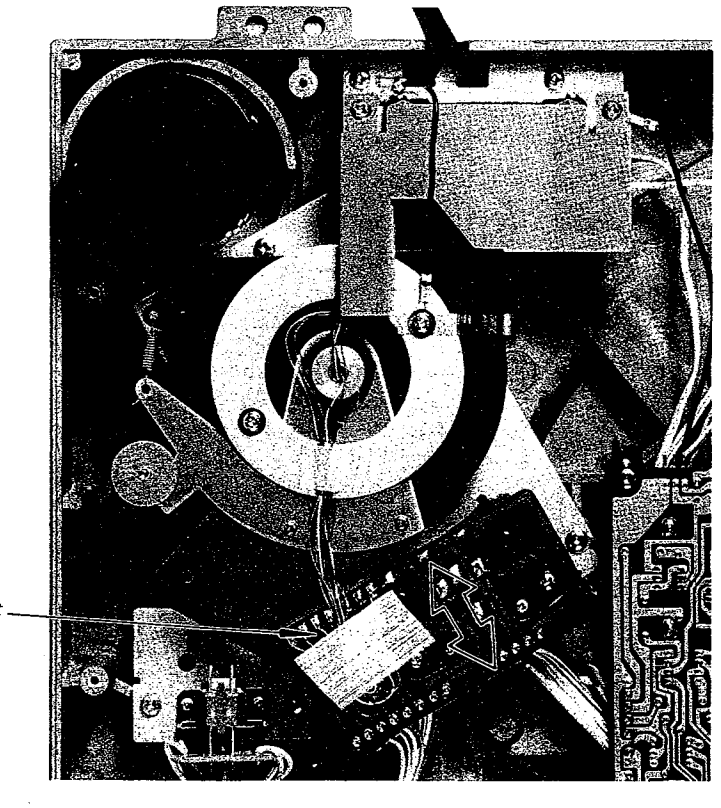



### Slit A and B Adjustments

1. Connect a dual-trace oscilloscope to TP9 (for slit B) and TP10 (for slit A).
2. Push the ARM TRANSPORT button ◁ (forward) or ▷ (back) and swing the tonearm.
3. During the tonearm swinging, adjust RV102 (slit B) and RV101 (slit A) to obtain the square waves as shown below.
4. Push the ARM TRANSPORT button ◁ (forward) or ▷ (back) and swing the tonearm.
5. Move the position-detecting board for the phase difference shown below.





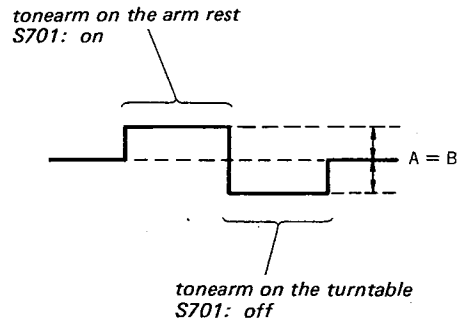

### Tonearm Horizontal/Vertical Motor Offset Adjustment

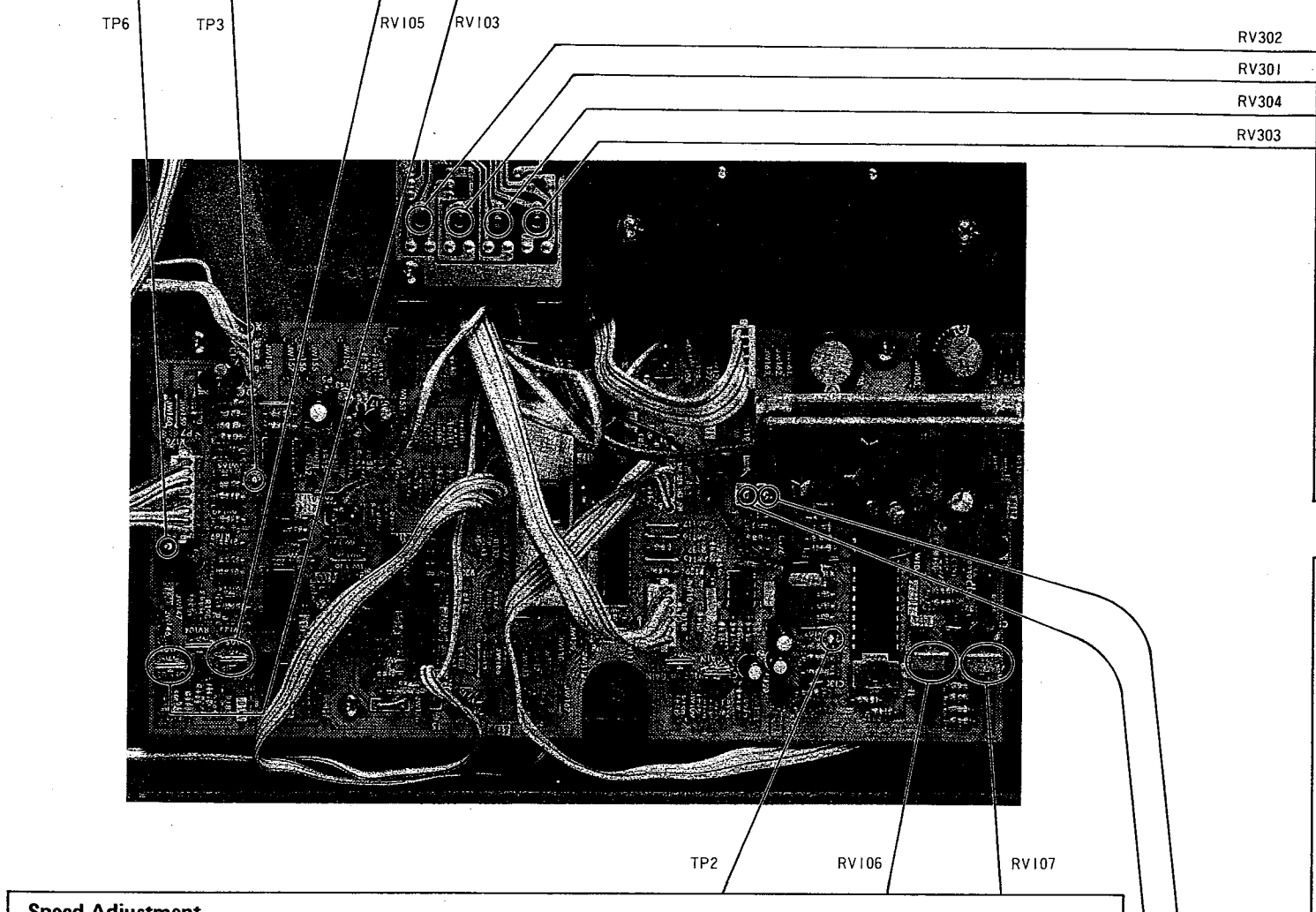
**A) Vertical Adjustment**

1. Secure the tonearm on the arm rest.
2. Turn S701 (ZERO BALANCE) on.
3. Connect an oscilloscope to TP3 and adjust RV103 to obtain 0 V.

**B) Horizontal Adjustment**

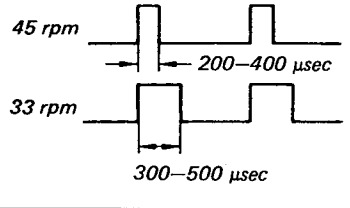
1. Connect an oscilloscope to TP6.
2. Secure the tonearm on the arm rest and adjust RV105 to make A and B equal as shown on the right.



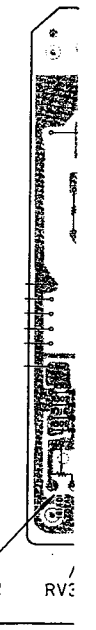

### Speed Adjustment

1. Set the SPEED to 45 rpm.
2. Connect an oscilloscope to TP2.
3. Adjust RV107 for a waveform as shown on the right.
4. Set the SPEED to 33 rpm.
5. Adjust RV106 for a waveform as shown on the right.
6. Confirm that the LOCKED indication is lighting up.




### Turntable Mo

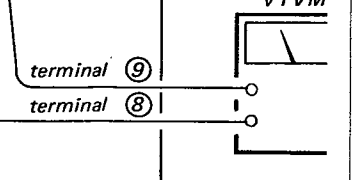
1. Make an
2. Connect a
3. Set the SP
4. Throw th RV302 fc
5. Throw th RV301 fc




### Speed-detecti

1. Set the SP
2. Connect a
3. Push the turntable.
4. Adjust the that the V

**Note:** The and than



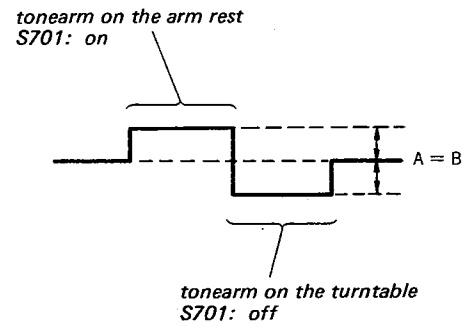
## Tonearm Horizontal/Vertical Motor Offset Adjustment

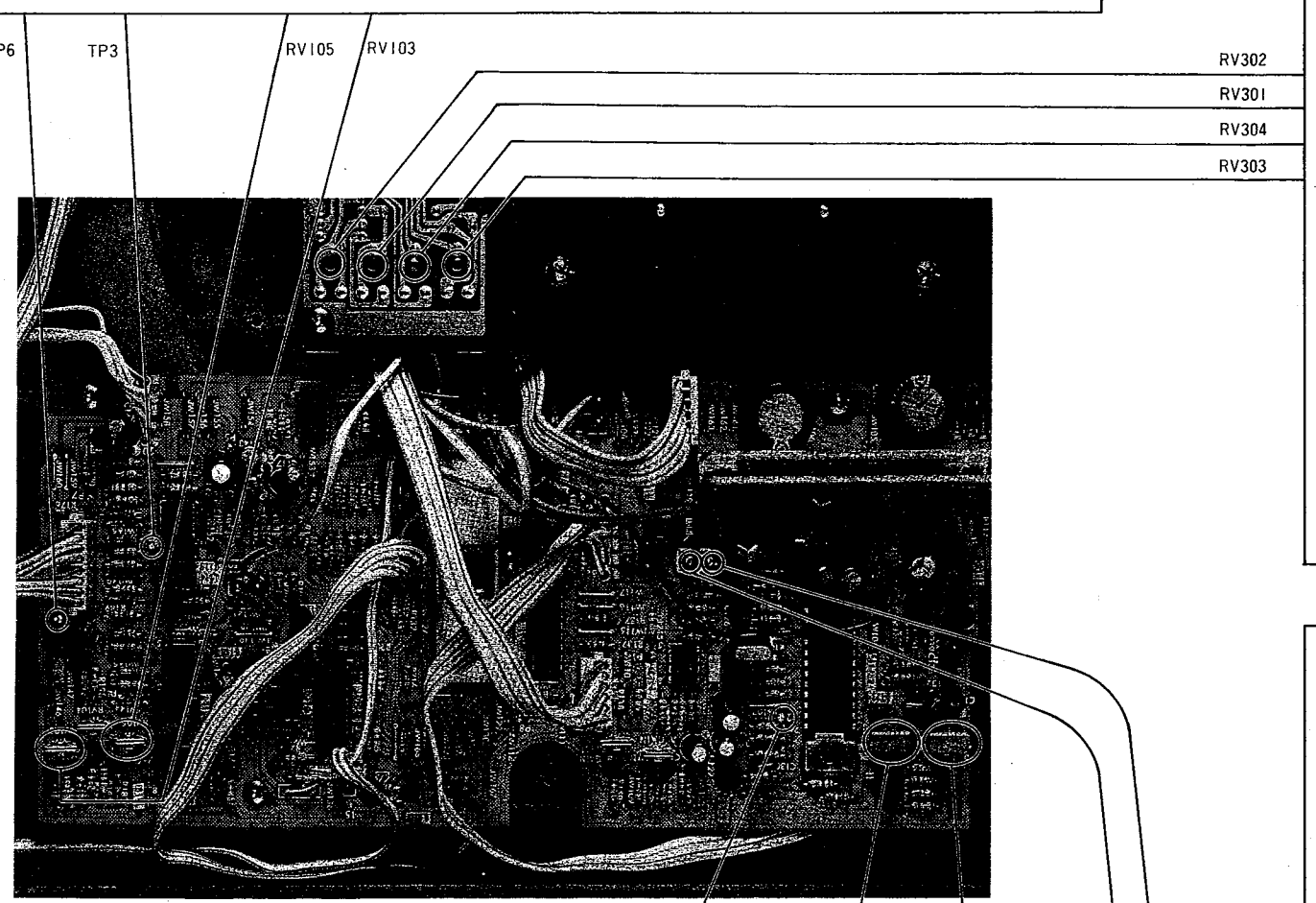
**A) Vertical Adjustment**

1. Secure the tonearm on the arm rest.
2. Turn S701 (ZERO BALANCE) on.
3. Connect an oscilloscope to TP3 and adjust RV103 to obtain 0 V.

**B) Horizontal Adjustment**

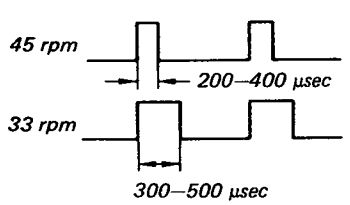
1. Connect an oscilloscope to TP6.
2. Secure the tonearm on the arm rest and adjust RV105 to make A and B equal as shown on the right.



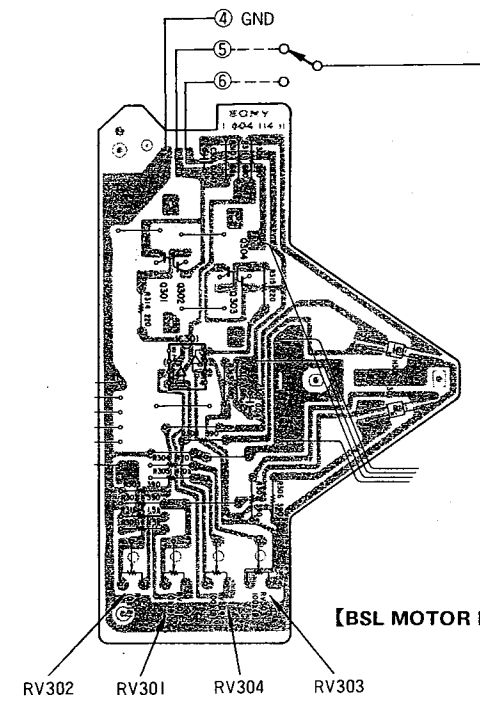

## Speed Adjustment

1. Set the SPEED to 45 rpm.
2. Connect an oscilloscope to TP2.
3. Adjust RV107 for a waveform as shown on the right.
4. Set the SPEED to 33 rpm.
5. Adjust RV106 for a waveform as shown on the right.
6. Confirm that the LOCKED indication is lighting up.

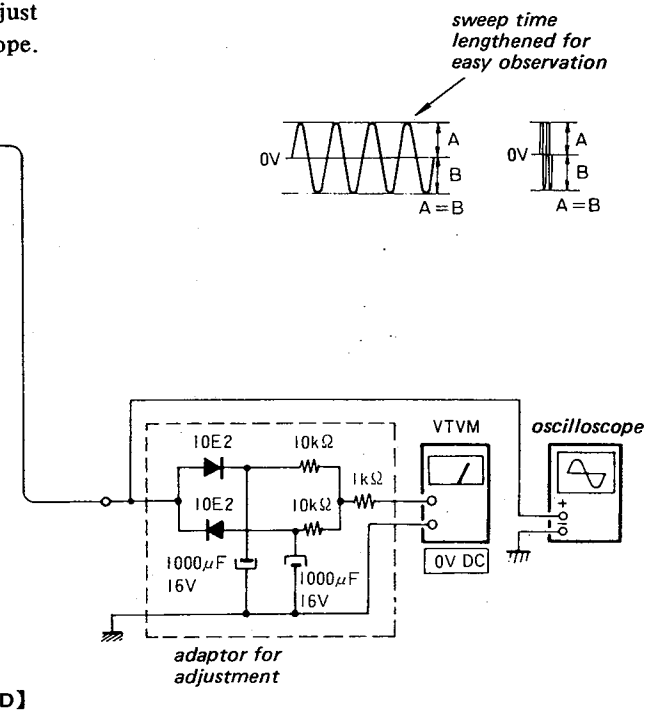


## Turntable Motor Adjustment

1. Make an adaptor for adjustment as shown below.
2. Connect a VTVM and an oscilloscope as shown.
3. Set the SPEED to 33 rpm.
4. Throw the switch to terminal ⑤ and adjust RV302 for a 4 $V_{p\text{-}p}$ reading on the oscilloscope.
5. Throw the switch to terminal ⑥ and adjust RV301 for a 4 $V_{p\text{-}p}$ reading on the oscilloscope.
6. Throw the switch to terminal ⑤ and adjust RV304 for a 0 V dc reading on the VTVM or for a waveform as shown below.
7. Throw the switch to terminal ⑥ and adjust RV303 for a 0 V dc reading on the VTVM or for a waveform as shown below.



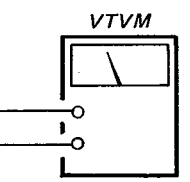

【BSL MOTOR BOARD】

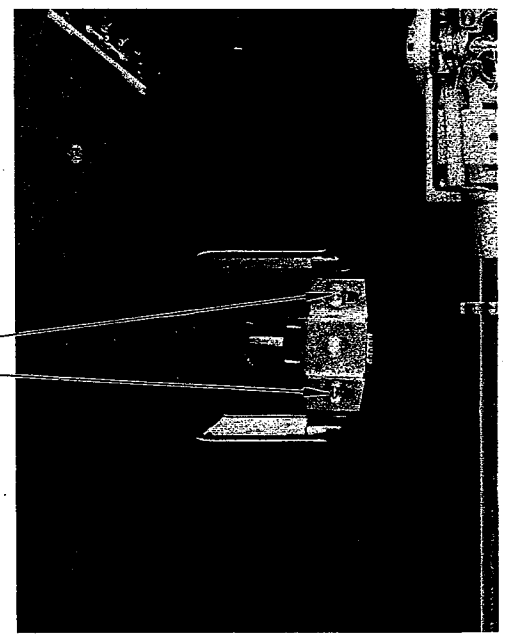



## Speed-detecting Head Output Level Adjustment

1. Set the SPEED to 33 rpm.
2. Connect a VTVM as shown below.
3. Push the START/STOP button to rotate the turntable.
4. Adjust the position of the speed-detecting head so that the VTVM reading is 20 mV ac to 50 mV ac.

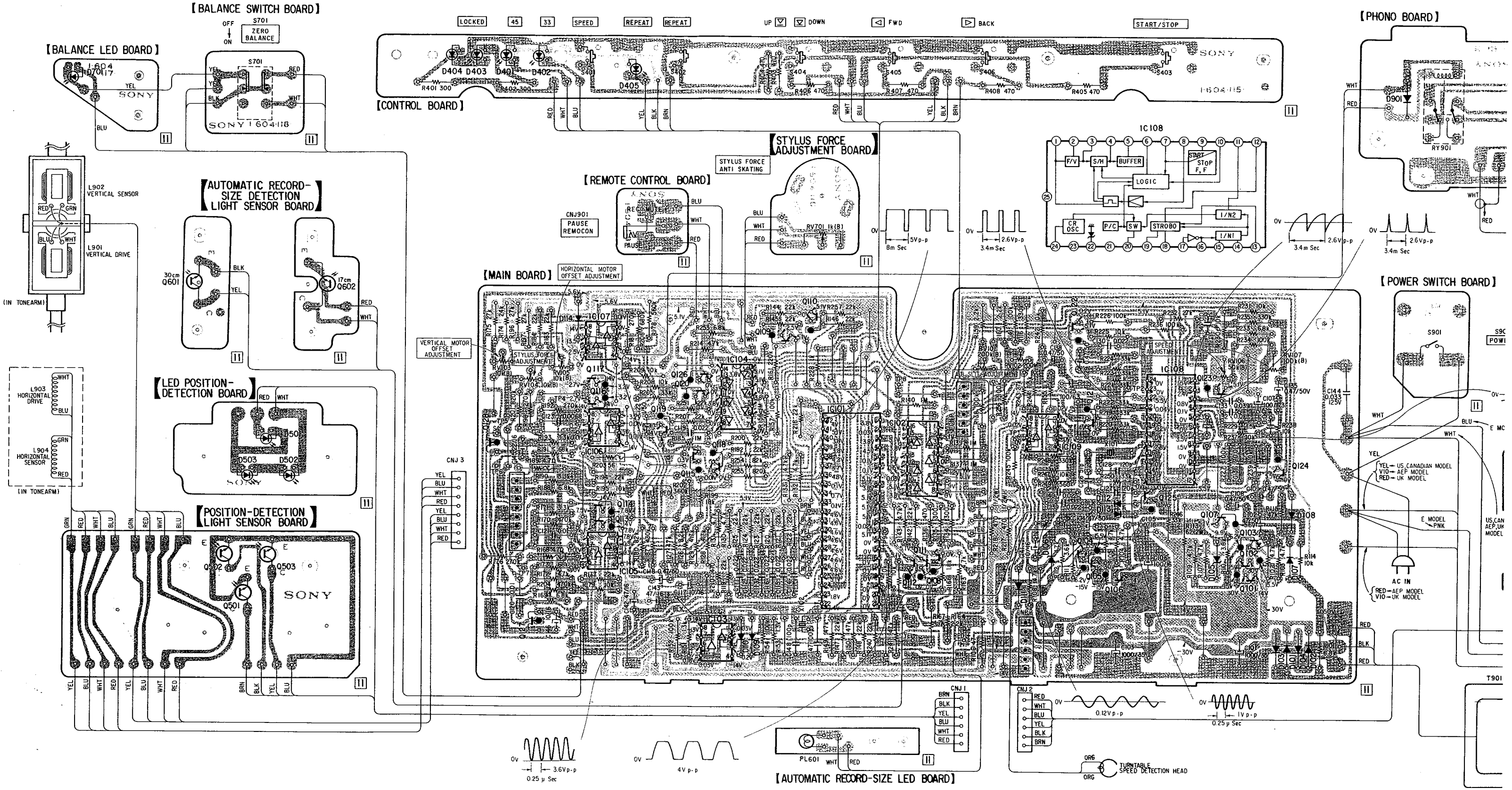
**Note:** The clearance between the magnet coated rim and the speed-detecting head should be more than 0.3 mm.



## 4-1. MOUNTING DIAGRAM

**SEMICONDUCTOR LEAD LAYOUTS and NOTE:** See page 26.




| | | |

D E F G H I J K

1 2 3 4 5

33 SPEED REPEAT REPEAT UP DOWN FWD BACK START/STOP

【REMOTE CONTROL BOARD】

【STYLUS FORCE ADJUSTMENT BOARD】

STYLUS FORCE ANTI SKATING

HORIZONTAL MOTOR OFFSET ADJUSTMENT

IC108

【PHONO BOARD】

【POWER SWITCH BOARD】

【BSL MOTOR BOARD】

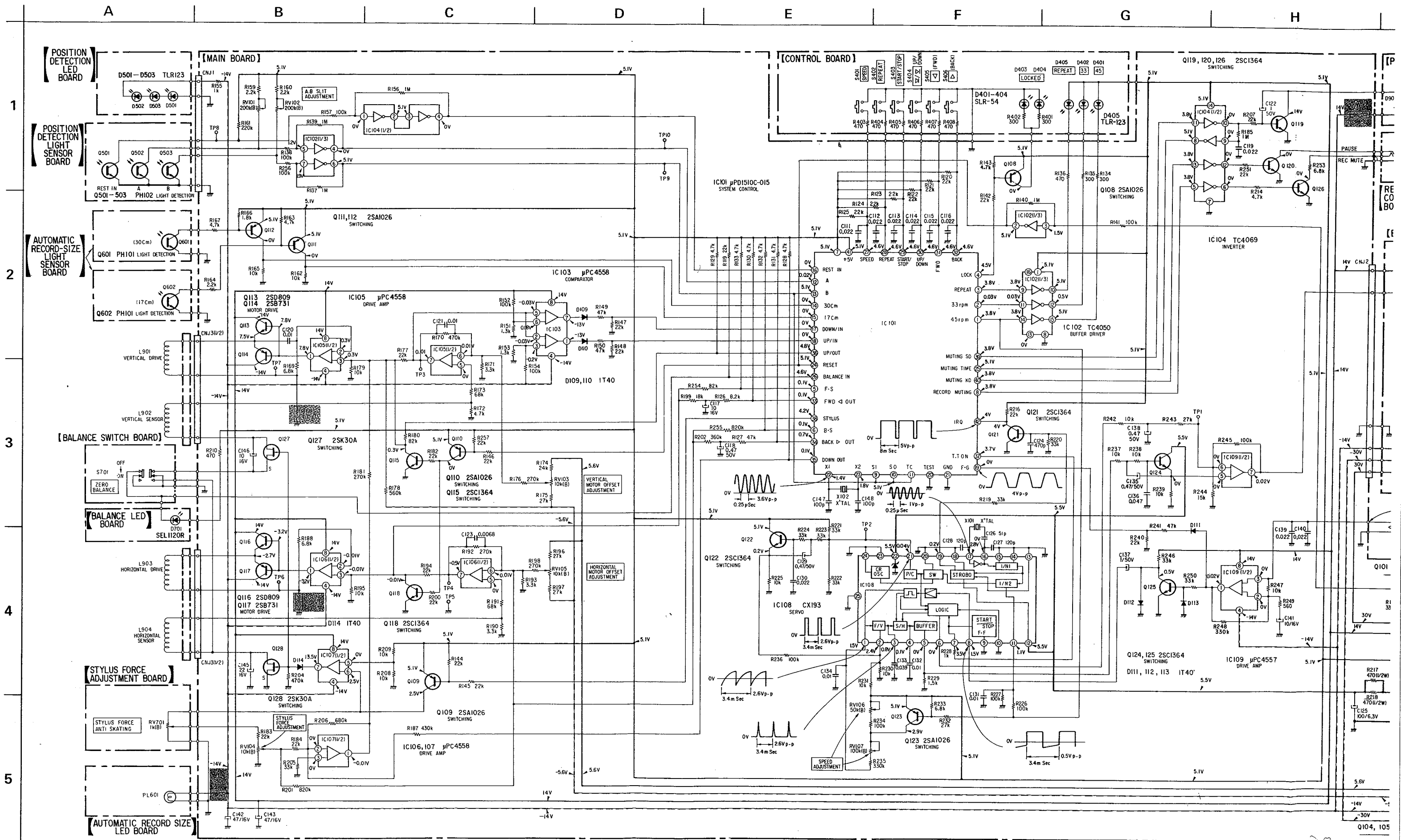
BSL TURNTABLE MOTOR

【AUTOMATIC RECORD-SIZE LED BOARD】

T901 POWER

| | | |

SEMICONDUCTOR LEAD LAYOUTS and NOTE: See page 26.



D E F G H I J K

1 2 3 4 5

[CONTROL BOARD]

S401 SPEED
S402 REPEAT
S403 START/STOP
S404 UP/DOWN
S405 (FWD)
S406 (BACK)

D403 D404 LOCKED
D405 REPEAT 33 45
D401-404 SLR-54
D405 TLR-123

R403 470 R404 470 R405 470 R406 470 R407 470 R408 470
R402 300 R401 300

IC101 μPD1510C-015
SYSTEM CONTROL

TP10
TP9

R123 22k R122 22k R121 22k R120 22k
R124 22k
R125 22k
C112 0.022 C113 0.022 C114 0.022 C115 0.022 C116 0.022
C111 0.022

R129 4.7k R119 22k R133 4.7k R130 4.7k R132 4.7k R131 4.7k R128 4.7k

REST IN
A
B
30Cm
17Cm
DOWN/IN
UP/IN
UP/OUT
RESET
BALANCE IN
F-S
FWD ◁ OUT
STYLUS
B-S
BACK ▷ OUT
DOWN OUT

+5V SPEED REPEAT START/STOP UP/DOWN FWD BACK

R254 82k R199 18k R126 8.2k C117 10 16V
R255 820k R202 360k R127 47k C118 0.47 50V

XI X2 SI SO TC TEST GND F-G
X102 X'TAL
C147 100p C148 100p

IC103 μPC4558
COMPARATOR
D109 D110
R149 47k R147 22k R150 47k R148 22k R154 100k
D109,110 1T40

R174 24k R176 270k RV103 10k(B) R175 27k
VERTICAL MOTOR OFFSET ADJUSTMENT

R198 270k RV105 10k(B) R193 3.3k R196 27k R197 27k
HORIZONTAL MOTOR OFFSET ADJUSTMENT

Q108 2SA1026
SWITCHING
R143 4.7k R142 22k R136 470 R135 300 R134 300
R140 1M R141 100k

IC102(1/3)

IC104 TC4069
INVERTER

IC102 TC4050
BUFFER DRIVER

LOCK
REPEAT
33rpm
45rpm
MUTING SO
MUTING TIME
MUTING KO
RECORD MUTING
IRQ
T.T ON

Q121 2SC1364
SWITCHING
R216 22k
C124 470p R220 33k

Q122 2SC1364
SWITCHING
R224 33k R223 33k R221 33k
C129 0.47/50V
R225 10k C130 0.022 R222 33k

IC108 CX193
SERVO
CR OSC P/C SW STROBE 1/N1 1/N2 LOGIC START STOP F-F F/V S/H BUFFER

R236 100k
C134 0.01
R231 10k R230 10k C133 0.039 C132 0.01 R229 1.5k
C131 0.01 R227 100k R226 100k

Q123 2SA1026
SWITCHING
R233 6.8k R234 100k R232 27k
RV106 50k(B) RV107 100k(B) R235 330k
SPEED ADJUSTMENT

Q119,120,126 2SC1364
SWITCHING
IC104(1/2)
C122 50V
R207 22k Q119
R185 1M C119 0.022
R251 22k Q120
R253 6.8k Q126
R214 4.7k

IC109 μPC4557
DRIVE AMP
Q124,125 2SC1364
SWITCHING
D111,112,113 1T40

R242 10k R243 27k TP1
C138 0.47 50V
R237 10k R238 10k Q124
C135 0.47/50V C136 0.047 R239 10k
R245 100k IC109(1/2)
R244 15k

R241 47k D111
C137 1/50V
R240 22k
R246 33k Q125
D112 D113
R250 33k
IC109(1/2)
R247 10k R249 560 C141 10/16V
R248 330k
C139 0.022 C140 0.022

[PHONO BOARD]
D901 1T40
RY901
L-CH
R-CH
(XL-20) AEP,E MODEL

PAUSE
REC MUTE
CNJ 901 PAUSE REMOCON

[REMOTE CONTROL BOARD]

[BSL MOTOR BOARD]
H301,302 HL300C
POSITION DETECTION
IC301 μPC4558
DRIVE AMP
Q301,303 2SD880
Q302,304 2SB834
MOTOR DRIVE

MAIN MOTOR GAIN ADJUSTMENT
RV302 10k(B) R316 1.5k
MAIN MOTOR OFFSET ADJUSTMENT
RV301 10k(B) R301 1.5k
RV303 100k(B) RV304 100k(B)
R303 390 R308 390 R309 390 R306 390 R307 390 R302 390
R305 470k R304 470k
R311 680 R310 68k C301 0.047 30V
R313 680 R312 68k C302 0.047 30V
R314 220 R315 220
L301 L302 BSL TURNTABLE MOTOR
US, CANADIAN MODEL
AEP,UK,E MODEL

TURNTABLE SPEED MGH DETECTION HEAD
0.12Vp-p

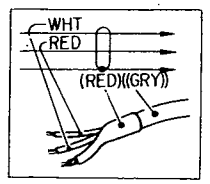
Q101 2SD880 Q102,103 2SC1364 Q107 2SD774 D107,108 1T40
VOLTAGE REG.
R116 330k C109 0.47 50V R115 47k C108 0.47/50V D107 D108 R114 10k R101 6.8k

[POWER SWITCH BOARD]

Q104,105 2SA1026 Q106 2SB834
VOLTAGE REG.
R217 470(1/2W) R218 470(1/2W) C125 100/6.3V C107 100 6.3V
C105 100 16V C106 100 16V
R109 4.7k R107 4.7k R102 4.7k R103 4.7k R110 3.6k R111 3.6k R112 4.7k R108 4.7k R104 4.7k R105 4.7k
C102 47/50 C104 47 50V
D105 D106

**Note: (For MOUNTING DIAGRAM)**

- Color code of sleeving over the end of the jacket.




- o— : parts extracted from the component side.
- ▒▒ : B + pattern
- ▒▒ : B – pattern

**Note: (For SCHEMATIC DIAGRAM)**

- All capacitors are in μF unless otherwise noted. pF : μμF 50WV or less are not indicated except for electrolytics and tantalums.
- ⌇⌇⌇: fusible resistor.
- ▭ : panel designation.
- ▭ : adjustment for repair.
- ——: B+ bus.
- – – –: B– bus.
- Waveforms and their voltage readings are taken with an oscilloscope.
  - turntable motor: OFF, 33 rpm
  - tonearm: rested on tonearm rest
  - tonearm lifter: upped
  - servo amp circuit: when turntable motor is turning
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no-signal conditions with a VOM (20 kΩ/V).
- Voltage variations may be noted due to normal production tolerances.
- Switch

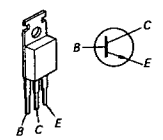
| Ref. No. | Switch | Position |
|---|---|---|
| S401 | SPEED | OFF |
| S402 | REPEAT | OFF |
| S403 | START/STOP | OFF |
| S404 | ▽ / ▽ (UP/DOWN) | OFF |
| S405 | ◁ (FWD) | OFF |
| S406 | ▷ (BACK) | OFF |
| S701 | ZERO BALANCE | OFF |
| S901 | POWER | OFF |
| S902 (model E) | VOLTAGE SELECTOR | 110–120 V |

**Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.**

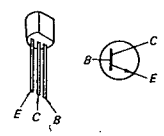
**Note: Les composants identifiés par une trame et une marque ⚠ sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.**

**Semiconductor Lead Layouts**

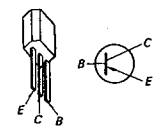
**2SD880**



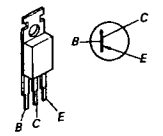

**2SC1364**



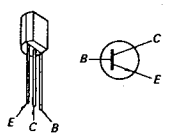

**2SA1027R**
**2SA1026**



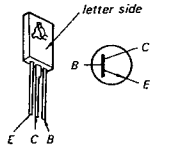

**2SB834**



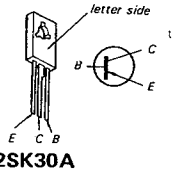

**2SD774**



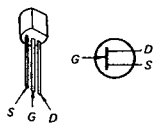

**2SD809**



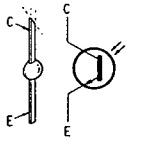

**2SB731**



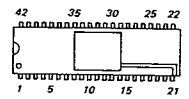

**2SK30A**



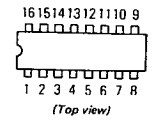

**PH102**
**PH101**



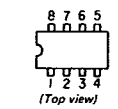

**μPD1510C-015**



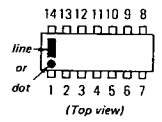

**TC4050BP**



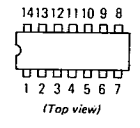

**μPC4558C**
**μPC4557C**



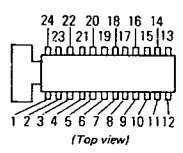

**MSM4069**



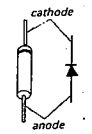

**TC4069UBP**



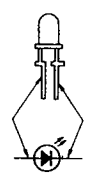

**CX193**



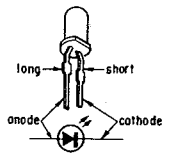

**1S1555**
**1T40**
**10E2**
**HZ6B1L**



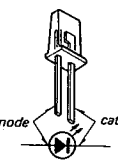

**SLR54URC**



**TLR123**




**SEL1120R**




**HL300C**

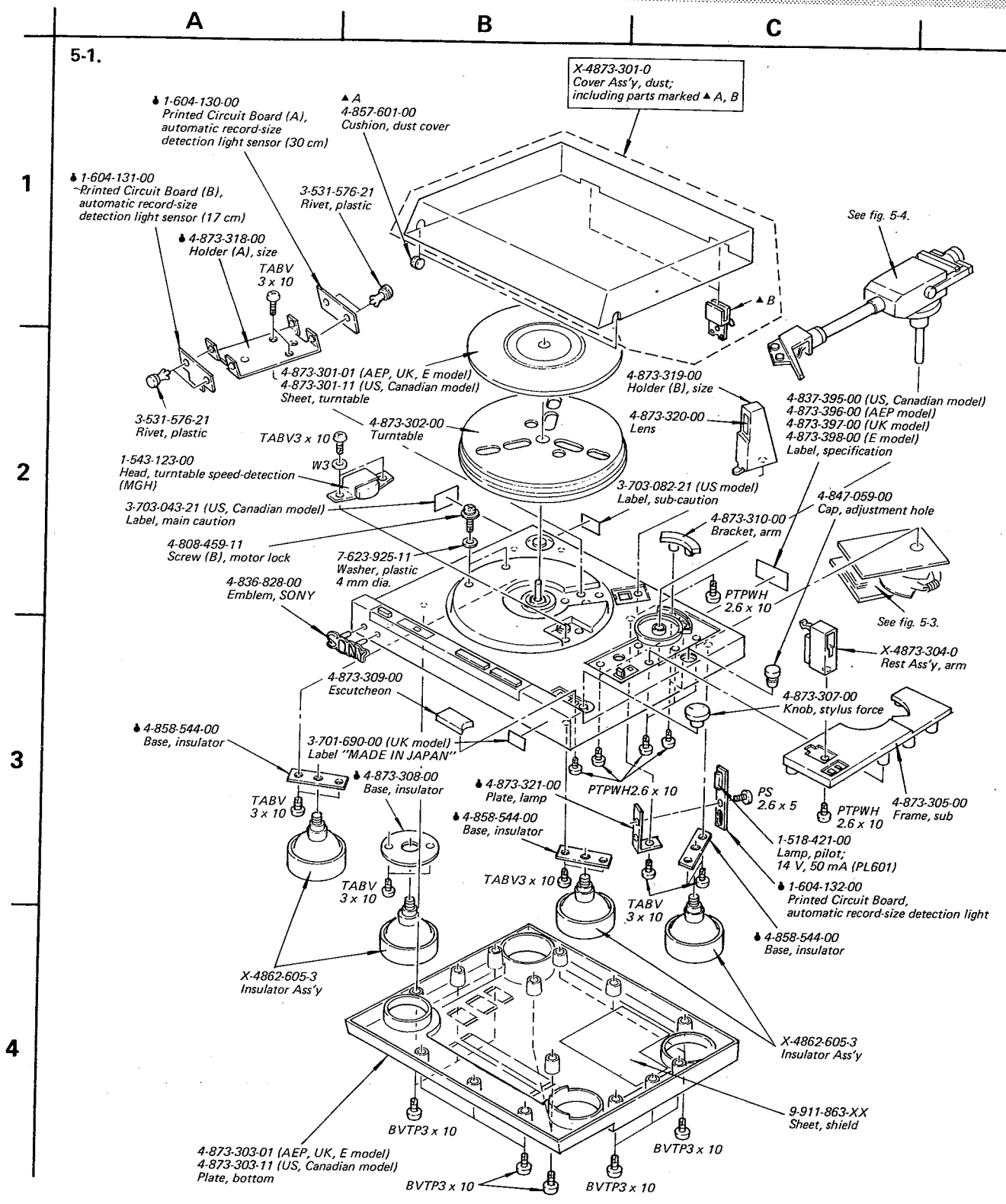
# SECTION 5
# EXPLODED VIEWS

**Note:**

- Items marked "♦" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- (□□T) shows the number of coils in spring.

**Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.**

**Note: Les composants identifiés par une trame et une marque ⚠ sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.**



# SECTION 5
# EXPLODED VIEWS

**Note:**

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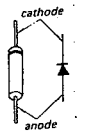
  (–) = slotted head
- (□□T) shows the number of coils in spring.

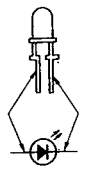
**Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.**

**Note: Les composants identifiés par une trame et une marque ⚠ sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.**

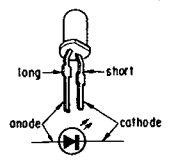
**1S1555**
**1T40**
**10E2**
**HZ6B1L**




**SLR54URC**



**TLR123**

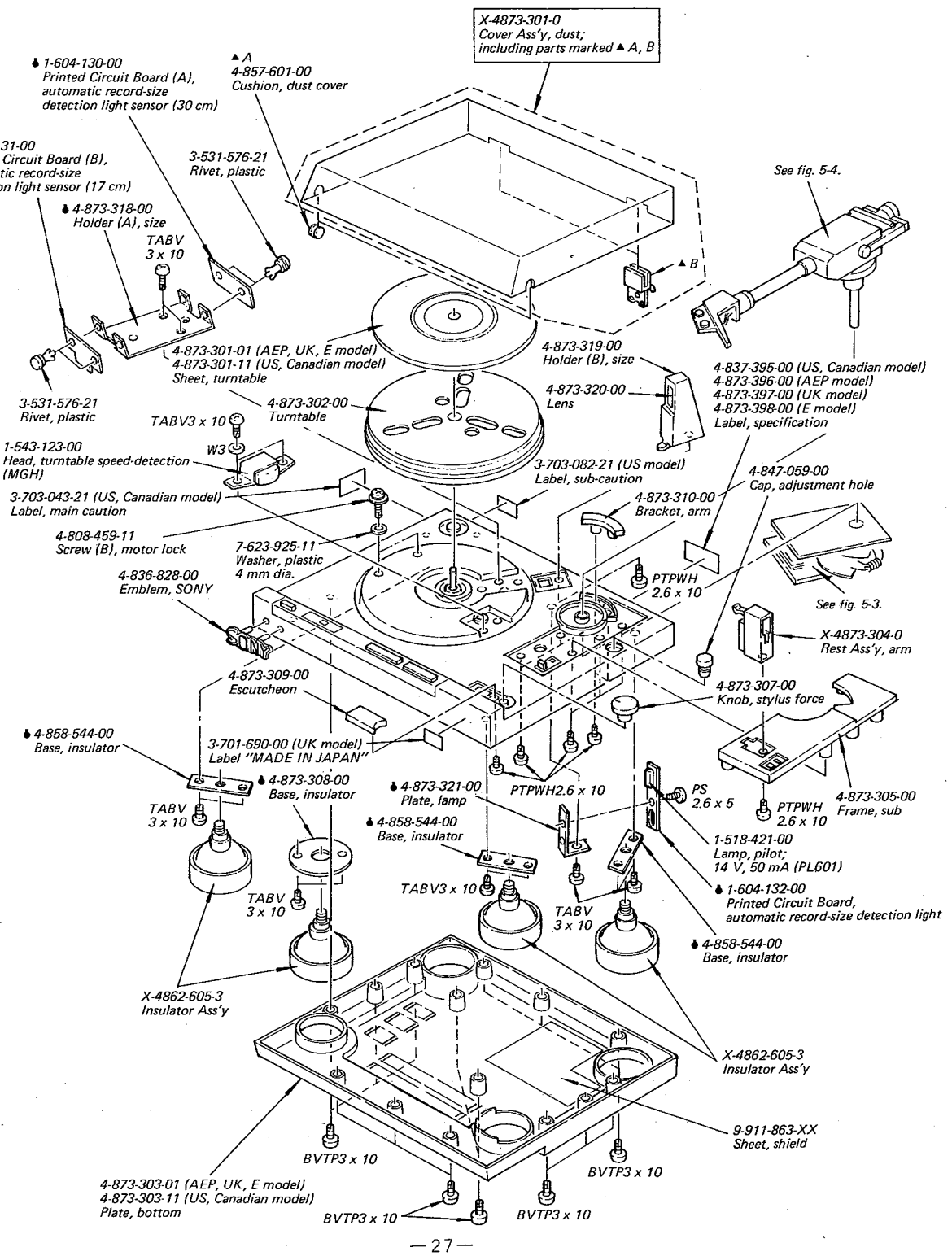



**SEL1120R**

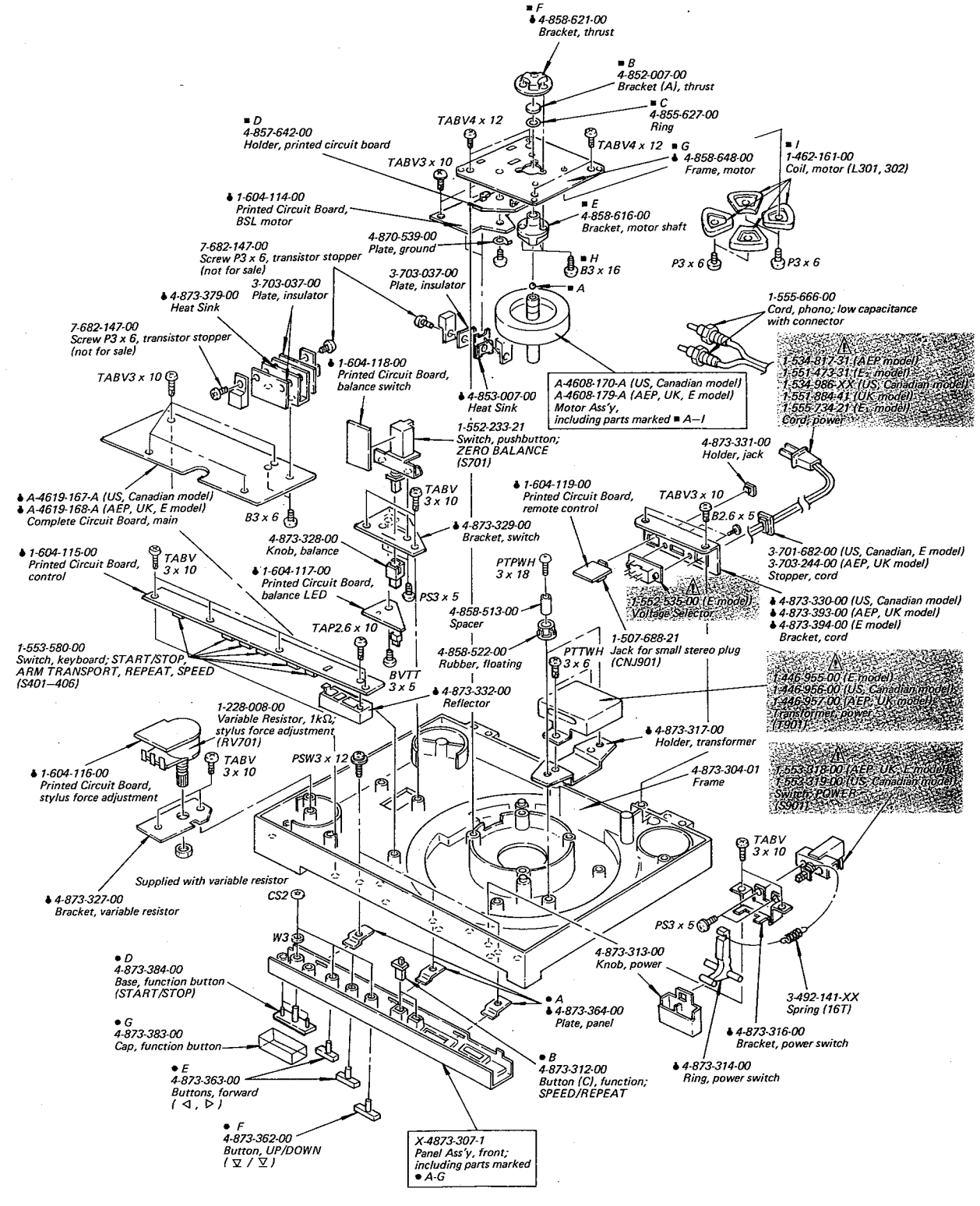



**HL300C**

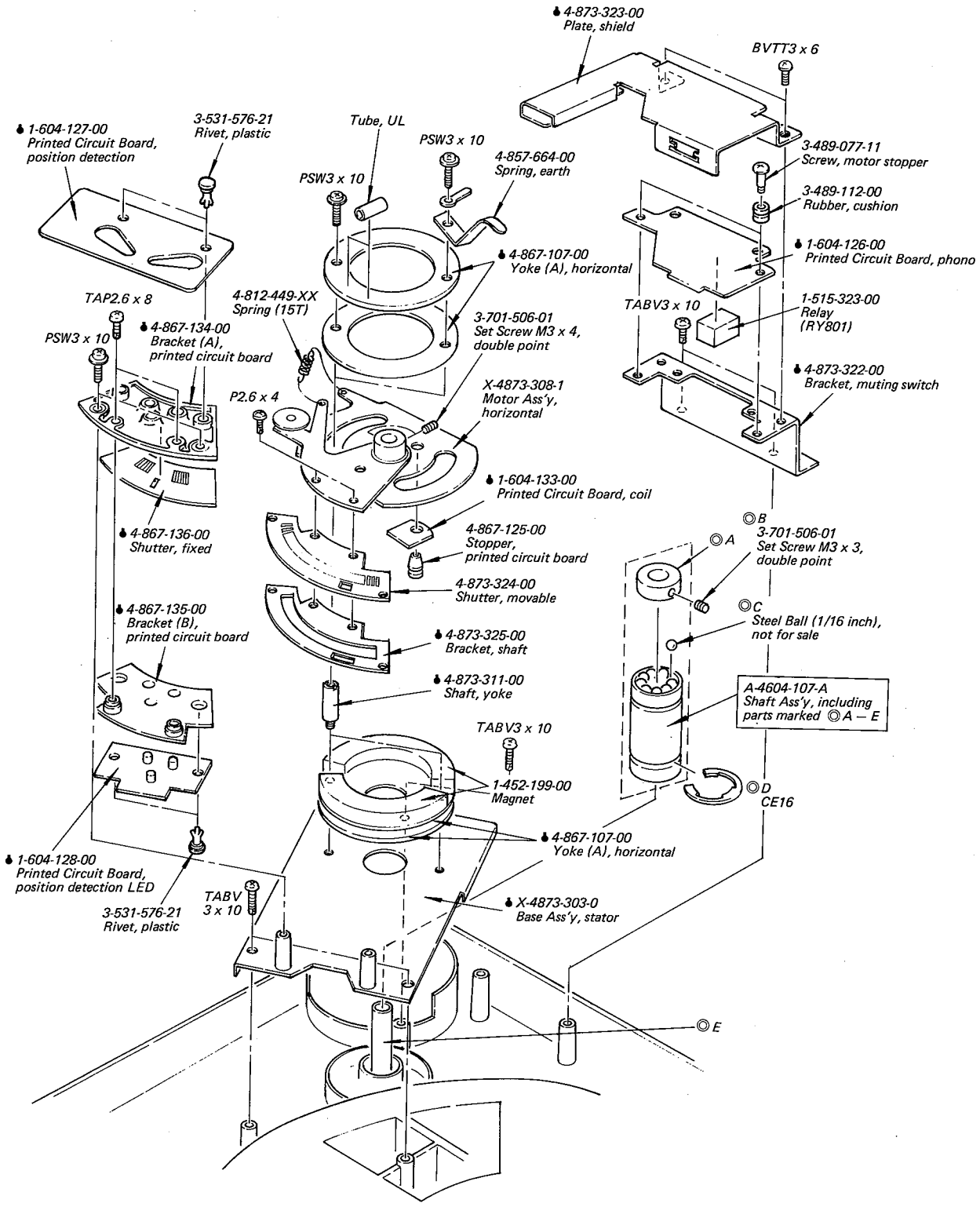
## 5-1.



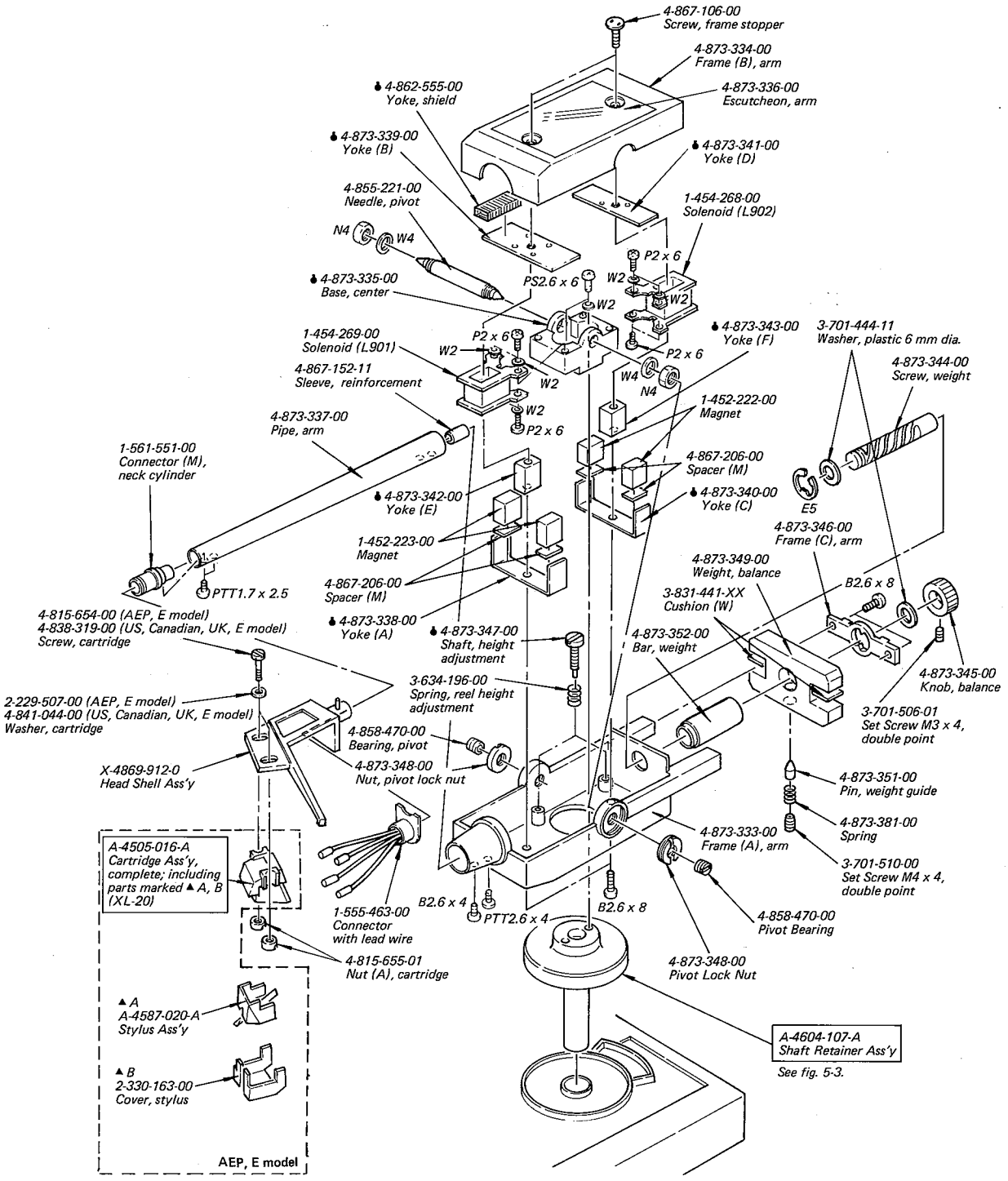

## 5-2.



5-3.


♦4-873-323-00
Plate, shield
BVTT3 x 6
♦1-604-127-00
Printed Circuit Board,
position detection
3-531-576-21
Rivet, plastic
Tube, UL
PSW3 x 10
PSW3 x 10
4-857-664-00
Spring, earth
3-489-077-11
Screw, motor stopper
3-489-112-00
Rubber, cushion
♦4-867-107-00
Yoke (A), horizontal
♦1-604-126-00
Printed Circuit Board, phono
TAP2.6 x 8
4-812-449-XX
Spring (15T)
TABV3 x 10
1-515-323-00
Relay
(RY801)
PSW3 x 10
♦4-867-134-00
Bracket (A),
printed circuit board
3-701-506-01
Set Screw M3 x 4,
double point
♦4-873-322-00
Bracket, muting switch
P2.6 x 4
X-4873-308-1
Motor Ass'y,
horizontal
♦1-604-133-00
Printed Circuit Board, coil
◎B
3-701-506-01
Set Screw M3 x 3,
double point
◎A
♦4-867-136-00
Shutter, fixed
4-867-125-00
Stopper,
printed circuit board
4-873-324-00
Shutter, movable
◎C
Steel Ball (1/16 inch),
not for sale
♦4-867-135-00
Bracket (B),
printed circuit board
♦4-873-325-00
Bracket, shaft
♦4-873-311-00
Shaft, yoke
A-4604-107-A
Shaft Ass'y, including
parts marked ◎A – E
TABV3 x 10
1-452-199-00
Magnet
◎D
CE16
♦4-867-107-00
Yoke (A), horizontal
♦1-604-128-00
Printed Circuit Board,
position detection LED
TABV
3 x 10
3-531-576-21
Rivet, plastic
♦X-4873-303-0
Base Ass'y, stator
◎E

5-4.


4-867-106-00
Screw, frame stopper
4-873-334-00
Frame (B), arm
4-873-336-00
Escutcheon, arm
4-862-555-00
Yoke, shield
4-873-339-00
Yoke (B)
4-873-341-00
Yoke (D)
4-855-221-00
Needle, pivot
1-454-268-00
Solenoid (L902)
N4
W4
P2 x 6
W2
4-873-335-00
Base, center
PS2.6 x 6
1-454-269-00
Solenoid (L901)
4-867-152-11
Sleeve, reinforcement
4-873-343-00
Yoke (F)
3-701-444-11
Washer, plastic 6 mm dia.
4-873-344-00
Screw, weight
1-452-222-00
Magnet
4-873-337-00
Pipe, arm
1-561-551-00
Connector (M), neck cylinder
4-867-206-00
Spacer (M)
4-873-340-00
Yoke (C)
E5
4-873-342-00
Yoke (E)
4-873-346-00
Frame (C), arm
1-452-223-00
Magnet
4-873-349-00
Weight, balance
B2.6 x 8
3-831-441-XX
Cushion (W)
PTT1.7 x 2.5
4-815-654-00 (AEP, E model)
4-838-319-00 (US, Canadian, UK, E model)
Screw, cartridge
4-873-338-00
Yoke (A)
4-873-347-00
Shaft, height adjustment
4-873-352-00
Bar, weight
4-873-345-00
Knob, balance
3-634-196-00
Spring, reel height adjustment
2-229-507-00 (AEP, E model)
4-841-044-00 (US, Canadian, UK, E model)
Washer, cartridge
3-701-506-01
Set Screw M3 x 4, double point
4-858-470-00
Bearing, pivot
X-4869-912-0
Head Shell Ass'y
4-873-348-00
Nut, pivot lock nut
4-873-351-00
Pin, weight guide
4-873-381-00
Spring
4-873-333-00
Frame (A), arm
3-701-510-00
Set Screw M4 x 4, double point
A-4505-016-A
Cartridge Ass'y, complete; including parts marked ▲A, B (XL-20)
B2.6 x 4
PTT2.6 x 4
B2.6 x 8
1-555-463-00
Connector with lead wire
4-858-470-00
Pivot Bearing
4-815-655-01
Nut (A), cartridge
4-873-348-00
Pivot Lock Nut
▲A
A-4587-020-A
Stylus Ass'y
▲B
2-330-163-00
Cover, stylus
AEP, E model
A-4604-107-A
Shaft Retainer Ass'y
See fig. 5-3.

# SECTION 6
# ELECTRICAL PARTS LIST

- Items marked "♦" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

**Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.**

**Note: Les composants identifiés par une trame et une marque ⚠ sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.**

| Ref. No. | Part No. | Description |
|---|---|---|
| | | **SEMICONDUCTORS** |
| | | **Transistors** |
| Q101 | 8-729-288-02 | 2SD880 |
| Q102, 103 | 8-729-663-47 | 2SC1364 |
| Q104, 105 | 8-729-612-77 | 2SA1027R |
| Q106 | 8-729-283-41 | 2SB834 |
| Q107 | 8-729-177-43 | 2SD774 |
| Q108–112 | 8-729-612-77 | 2SA1027R |
| Q113 | 8-729-180-93 | 2SD809 |
| Q114 | 8-729-173-13 | 2SB731 |
| Q115 | 8-729-663-47 | 2SC1364 |
| Q116 | 8-729-180-93 | 2SD809 |
| Q117 | 8-729-173-13 | 2SB731 |
| Q118–122 | 8-729-663-47 | 2SC1364 |
| Q123 | 8-729-612-77 | 2SA1027R |
| Q124–126 | 8-729-663-47 | 2SC1364 |
| Q127, 128 | 8-729-203-04 | 2SK30A |
| Q301 | 8-729-288-02 | 2SD880 |
| Q302 | 8-729-283-41 | 2SB834 |
| Q303 | 8-729-288-02 | 2SD880 |
| Q304 | 8-729-283-41 | 2SB834 |
| Q501–503 | 8-729-101-02 | PH102 |
| Q601, 602 | 8-729-101-01 | PH101 |
| | | **ICs** |
| IC101 | 8-759-115-15 | μPD1510C-015 |
| IC102 | 8-759-240-50 | TC4050BP |
| IC103 | 8-759-145-58 | μPC4558C |
| IC104 | 8-759-904-69 | MSM4069 |
| IC105–107 | 8-759-145-58 | μPC4558C |
| IC108 | 8-751-930-00 | CX193 |
| IC109 | 8-759-145-57 | μPC4557C |
| IC301 | 8-759-145-58 | μPC4558C |
| | | **Diodes** |
| D101–104 | ⚠ 8-719-200-02 | 10E2 |
| D105, 106 | 8-719-910-64 | HZ6B1L |
| D107–114 | 8-719-815-55 | 1S1555 |
| D401–404 | 8-719-905-40 | SLR54URC |
| D405, D501–503 | 8-719-812-31 | TLR123 |
| D701 | 8-719-311-20 | SEL1120R |
| D901 | 8-719-815-55 | 1S1555 |
| H301, 302 | 8-719-903-00 | HL300C |

**CAPACITORS**

All capacitors are in μF. 50 V or less are not indicated. Common capacitors are omitted. Refer to the lists on pages 33 and 34 for their part numbers.

| | | | | | |
|---|---|---|---|---|---|
| C101, 103 | ⚠ 1-123-349-00 | 1,000 | 35 V | electrolytic |
| C144 | ⚠ 1-161-744-00 | 0.01 | 400 V | ceramic (AEP, UK, E model) |
| | ⚠ 1-161-749-00 | 0.01 | 125 V | ceramic (US, Canadian model) |

**RESISTORS**

All resistors are in ohm. Common ¼ W carbon resistors are omitted. Refer to the list on page 35 for their part numbers.

| | | | | |
|---|---|---|---|---|
| R106 | ⚠ 1-217-395-00 | 47 | ¼ W | fusible |
| R113 | ⚠ 1-206-482-00 | 62 | 2 W | metal oxide |
| R168, 189 | ⚠ 1-212-849-00 | 4.7 | ¼ W | fusible (nonflammable) |
| R203 | ⚠ 1-212-875-00 | 56 | ¼ W | fusible |
| R317, 318 | ⚠ 1-212-849-00 | 4.7 | ¼ W | fusible (nonflammable) (AEP, UK, E model) |
| RV101, 102 | 1-226-435-00 | 200 k, adjustable | | |
| RV103–105 | 1-226-431-00 | 10 k, adjustable | | |
| RV106 | 1-224-661-00 | 50 k, adjustable | | |
| RV107 | 1-226-938-00 | 100 k, adjustable | | |
| RV301, 302 | 1-226-236-00 | 10 k, adjustable | | |
| RV303, 304 | 1-226-239-00 | 100 k, adjustable | | |
| RV701 | 1-228-008-00 | 1 k, variable | | |

**MISCELLANEOUS**

| | | |
|---|---|---|
| L101, 102 | 1-407-157-XX | Coil, microinductor, 10 μH |
| L301, 302 | 1-462-161-00 | Coil, motor |
| L901 | 1-454-269-00 | Solenoid |
| L902 | 1-454-268-00 | Solenoid |



| Ref. No. | Part No. | Description |
|---|---|---|
| MGH | 1-543-123-00 | Head, turntable speed-detection |
| PL601 | 1-518-421-00 | Lamp 14 V 50 mA |
| S401–406 | 1-553-580-00 | Switch, keyboard |
| S701 | 1-552-233-00 | Switch, ZERO BALANCE |
| S901 | ⚠ 1-553-319-00 | Switch, pushbutton; POWER (US, Canadian model) |
| | ⚠ 1-553-318-00 | Switch, pushbutton; POWER (AEP, UK, E model) |
| S902 | ⚠ 1-552-535-00 | Voltage Selector (E model) |
| T901 | ⚠ 1-446-955-00 | Transformer, power (E model) |
| | ⚠ 1-446-956-00 | Transformer, power (US, Canadian model) |
| | ⚠ 1-446-957-00 | Transformer, power (AEP, UK model) |
| RY801 | 1-515-323-00 | Relay |
| X101 | 1-527-380-00 | Crystal |
| | 1-527-380-21 | Crystal |
| X102 | 1-527-802-00 | Crystal, ceramic |
| | 1-452-199-00 | Magnet |
| | 1-452-222-00 | Magnet |
| | 1-452-223-00 | Magnet |
| | ⚠ 1-534-817-31 | Cord, power (AEP model) |
| | ⚠ 1-534-986-XX | Cord, power (US, Canadian model) |
| | ⚠ 1-551-473-31 | Cord, power (E2 model) |
| | ⚠ 1-551-884-41 | Cord, power (UK model) |
| | 1-555-666-00 | Cord with plug |
| | ⚠ 1-555-734-21 | Cord, power (E1 model) |
| | 1-561-551-00 | Connector, neck cylinder |

**COMPLETE CIRCUIT BOARDS**

| | |
|---|---|
| ♦ A-4619-167-A | Main (US, Canadian model) |
| ♦ A-4619-168-A | Main (AEP, UK, E model) |

**PRINTED CIRCUIT BOARDS**

| | |
|---|---|
| ♦ 1-604-114-00 | BSL motor |
| ♦ 1-604-115-00 | Control |
| ♦ 1-604-116-00 | Stylus Force Adjustment |
| ♦ 1-604-117-00 | Balance LED |
| ♦ 1-604-118-00 | Balance SW |
| ♦ 1-604-119-00 | Remote Control |
| ♦ 1-604-126-00 | Phono |
| ♦ 1-604-127-00 | Position Detection Light Sensor |
| ♦ 1-604-128-00 | Position Detection LED |
| ♦ 1-604-130-00 | Automatic Record Size Detection Light Sensor (A) |
| ♦ 1-604-131-00 | Automatic Record Size Detection Light Sensor (B) |
| ♦ 1-604-132-00 | Automatic Record Size LED |
| ♦ 1-604-133-00 | Coil |

**ACCESSORIES & PACKING MATERIALS**

| Part No. | Description |
|---|---|
| X-4869-912-0 | Head Shell Ass'y |
| X-4869-915-0 | Screw Ass'y, cartridge (US, Canadian model) |
| 1-555-463-00 | Connector with lead wires |
| 3-701-616-00 | Bag, polyethylene |
| 3-701-630-00 | Bag, polyethylene |
| 3-701-806-00 | Adaptor 45 rpm |
| 3-783-448-21 | Manual, instruction |
| 3-795-096-11 | Card, caution on zero balance |
| 4-815-655-02 | Nut (A), cartridge |
| 4-838-319-00 | Screw (B), cartridge (US, Canadian, UK, E model) |
| 4-841-044-00 | Washer, cartridge (US, Canadian, UK, E model) |
| 4-847-314-00 | Bag, polyethylene |
| 4-869-962-00 | Adjustor, drop point |
| 4-873-301-11 | Sheet, turntable (US, Canadian model) |
| 4-873-302-00 | Turntable |
| 4-873-306-00 | Sub-weight |
| 4-873-386-00 | Cushion, right |
| 4-873-387-00 | Cushion, left |
| 4-873-388-00 | Boxes, accessories |
| 4-873-390-00 | Holder, turntable |
| 4-873-391-00 | Plate, protection |
| 4-873-392-00 | Cushion, tonearm |
| 4-873-400-00 | Carton, individual |

## ELECTROLYTIC CAPACITORS

| CAP. (μF) | 6.3 VOLT. | 10 VOLT. | 16 VOLT. | 25 VOLT. | 35 VOLT. | 50 VOLT. |
|---|---|---|---|---|---|---|
| | PART No. | PART No | PART No. | PART No. | PART No. | PART No. |
| 0.47 | | | | | → | 1-121-726-00 |
| 1.0 | | | | | → | 1-121-391-00 |
| 2.2 | | | | | → | 1-121-450-00 |
| 3.3 | → | → | → | 1-121-392-00 | → | 1-121-393-00 |
| 4.7 | → | → | → | 1-121-395-00 | → | 1-121-396-00 |
| 10 | → | → | 1-121-651-00 | 1-121-398-00 | → | 1-121-738-00 |
| 22 | → | → | 1-121-479-00 | 1-121-480-00 | 1-121-662-00 | 1-121-152-00 |
| 33 | → | → | 1-121-403-00 | 1-121-404-00 | 1-121-652-00 | 1-121-405-00 |
| 47 | → | 1-121-352-00 | 1-121-409-00 | 1-121-410-00 | 1-121-653-00 | 1-121-411-00 |
| 100 | → | 1-121-414-00 | 1-121-415-00 | 1-121-416-00 | 1-121-357-00 | 1-121-417-00 |
| 220 | 1-121-419-00 | 1-121-420-00 | 1-121-421-00 | 1-121-422-00 | 1-121-261-00 | 1-121-423-00 |
| 330 | 1-121-751-00 | 1-121-805-00 | 1-121-521-00 | 1-121-654-00 | 1-121-655-00 | 1-121-656-00 |
| 470 | 1-121-424-00 | 1-121-425-00 | 1-121-426-00 | 1-121-733-00 | 1-121-361-00 | 1-121-810-00 |
| 1000 | – | 1-121-736-00 | 1-121-245-00 | 1-121-657-00 | 1-121-388-00 | 1-123-061-00 |
| 2200 | 1-121-658-00 | 1-121-659-00 | 1-121-660-00 | 1-123-067-00 | 1-121-984-00 | – |
| 3300 | 1-121-661-00 | 1-123-075-00 | 1-123-071-00 | – | – | – |

| CAP. (μF) | 100 VOLT. | 160 VOLT. | 250 VOLT. | 350 VOLT. |
|---|---|---|---|---|
| | PART No. | PART No. | PART No. | PART No. |
| 0.47 | – | – | – | – |
| 1.0 | 1-123-249-00 | 1-123-252-00 | 1-123-003-00 | 1-121-168-00 |
| 2.2 | 1-123-250-00 | 1-123-026-00 | – | 1-123-028-00 |
| 3.3 | 1-121-995-00 | – | 1-123-004-00 | 1-123-006-00 |
| 4.7 | 1-123-255-00 | 1-121-246-00 | 1-121-759-00 | 1-123-007-00 |
| 10 | 1-121-126-00 | 1-121-999-00 | 1-123-254-00 | 1-123-008-00 |
| 22 | 1-121-996-00 | 1-123-253-00 | 1-123-005-00 | 1-123-022-00 |
| 33 | 1-121-997-00 | 1-121-757-00 | – | – |
| 47 | 1-123-251-00 | 1-121-919-00 | – | – |
| 100 | 1-123-084-00 | – | – | – |

## CERAMIC CAPACITORS

| CAP. (pF) | 50 VOLT. | CAP. (pF) | 50 VOLT. | CAP. (pF) | 50 VOLT. | CAP. (μF) | 50 VOLT. |
|---|---|---|---|---|---|---|---|
| | PART No. | | PART No. | | PART No. | | PART No. |
| 0.5 | 1-101-837-00 | 22 | 1-102-959-00 | 150 | 1-101-361-00 | 0.001 | 1-102-074-00 |
| 0.75 | 1-101-586-00 | 24 | 1-102-960-00 | 160 | 1-101-367-00 | 0.0012 | 1-102-118-00 |
| 1.0 | 1-102-934-00 | 27 | 1-102-961-00 | 180 | 1-102-976-00 | 0.0015 | 1-102-119-00 |
| 1.5 | 1-101-576-00 | 30 | 1-102-962-00 | 200 | 1-102-977-00 | 0.0018 | 1-102-120-00 |
| 2.0 | 1-102-935-00 | 33 | 1-102-963-00 | 220 | 1-102-978-00 | 0.0022 | 1-102-121-00 |
| 3 | 1-102-936-00 | 36 | 1-102-964-00 | 240 | 1-102-979-00 | 0.0027 | 1-102-122-00 |
| 4 | 1-102-937-00 | 39 | 1-102-965-00 | 270 | 1-102-980-00 | 0.0033 | 1-102-123-00 |
| 5 | 1-102-942-00 | 43 | 1-102-966-00 | 300 | 1-102-981-00 | 0.0039 | 1-102-124-00 |
| 6 | 1-102-943-00 | 47 | 1-101-880-00 | 330 | 1-102-820-00 | 0.0047 | 1-102-125-00 |
| 7 | 1-102-944-00 | 51 | 1-101-882-00 | 360 | 1-102-821-00 | 0.0056 | 1-102-126-00 |
| 8 | 1-102-945-00 | 56 | 1-101-884-00 | 390 | 1-102-822-00 | 0.0068 | 1-102-127-00 |
| 9 | 1-102-946-00 | 62 | 1-101-886-00 | 430 | 1-102-823-00 | 0.0082 | 1-102-128-00 |
| 10 | 1-102-947-00 | 68 | 1-101-888-00 | 470 | 1-102-824-00 | 0.01 | 1-102-129-00 |
| 11 | 1-102-948-00 | 75 | 1-101-890-00 | 510 | 1-101-059-00 | 0.022 | 1-101-005-00 |
| 12 | 1-102-949-00 | 82 | 1-102-971-00 | 560 | 1-102-115-00 | 0.047 | 1-101-006-00 |
| 13 | 1-102-950-00 | 91 | 1-102-972-00 | 680 | 1-102-116-00 | | |
| 15 | 1-102-951-00 | 100 | 1-102-973-00 | 820 | 1-102-117-00 | | |
| 16 | 1-102-952-00 | 110 | 1-102-815-00 | | | | |
| 18 | 1-102-953-00 | 120 | 1-102-816-00 | | | | |
| 20 | 1-102-958-00 | 130 | 1-101-081-00 | | | | |

0.001μF = 1,000pF

## CERAMIC (SEMICONDUCTOR) CAPACITORS

RATING → : Use the high voltage rated one.

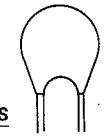
| CAP. (μF) | 25 VOLT. | 50 VOLT. | CAP. (μF) | 25 VOLT. | 50 VOLT. |
|---|---|---|---|---|---|
| | PART No. | PART No. | | PART No. | PART No. |
| 0.001 | → | 1-161-039-00 | 0.018 | 1-161-016-00 | 1-161-054-00 |
| 0.0012 | → | 1-161-040-00 | 0.022 | 1-161-017-00 | 1-161-055-00 |
| 0.0015 | | 1-161-041-00 | 0.027 | 1-161-018-00 | 1-161-056-00 |
| 0.0018 | | 1-161-042-00 | 0.033 | 1-161-019-00 | 1-161-057-00 |
| 0.0022 | | 1-161-043-00 | 0.039 | 1-161-010-00 | 1-161-058-00 |
| 0.0027 | → | 1-161-044-00 | 0.047 | 1-161-021-00 | 1-161-059-00 |
| 0.0033 | → | 1-161-045-00 | 0.056 | → | 1-161-060-00 |
| 0.0039 | → | 1-161-046-00 | 0.068 | → | 1-161-061-00 |
| 0.0047 | → | 1-161-047-00 | 0.082 | 1-161-024-00 | 1-161-062-00 |
| 0.0056 | → | 1-161-048-00 | 0.1 | 1-161-025-00 | 1-161-063-00 |
| 0.0068 | → | 1-161-049-00 | | | |
| 0.0082 | 1-161-012-00 | 1-161-050-00 | | | |
| 0.01 | 1-161-013-00 | 1-161-051-00 | | | |
| 0.012 | → | 1-161-052-00 | | | |
| 0.015 | 1-161-015-00 | 1-161-053-00 | | | |



## MYLAR CAPACITORS

RATING

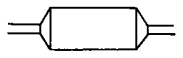
| CAP. (μF) | 50 VOLT. | 100 VOLT. | 200 VOLT. | CAP. (μF) | 50 VOLT. | 100 VOLT. | 200 VOLT. | CAP. (μF) | 50 VOLT. | 100 VOLT. | 200 VOLT. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | PART No. | PART No. | PART No. | | PART No. | PART No. | PART No. | | PART No. | PART No. | PART No. |
| 0.001 | 1-108-227-00 | 1-108-365-00 | 1-108-409-00 | 0.01 | 1-108-239-00 | 1-108-377-00 | 1-108-421-00 | 0.1 | 1-108-251-00 | 1-108-389-00 | 1-108-433-00 |
| 0.0012 | 1-108-351-00 | 1-108-366-00 | 1-108-410-00 | 0.012 | 1-108-357-00 | 1-108-378-00 | 1-108-422-00 | 0.12 | 1-108-363-00 | 1-108-390-00 | 1-108-434-00 |
| 0.0015 | 1-108-228-00 | 1-108-367-00 | 1-108-411-00 | 0.015 | 1-108-240-00 | 1-108-379-00 | 1-108-423-00 | 0.15 | 1-108-252-00 | 1-108-391-00 | 1-108-435-00 |
| 0.0018 | 1-108-352-00 | 1-108-368-00 | 1-108-412-00 | 0.018 | 1-108-358-00 | 1-108-380-00 | 1-108-424-00 | 0.18 | 1-108-364-00 | 1-108-392-00 | 1-108-436-00 |
| 0.0022 | 1-108-230-00 | 1-108-369-00 | 1-108-413-00 | 0.022 | 1-108-242-00 | 1-108-381-00 | 1-108-425-00 | 0.22 | 1-108-254-00 | 1-108-393-00 | 1-108-437-00 |
| 0.0027 | 1-108-353-00 | 1-108-370-00 | 1-108-414-00 | 0.027 | 1-108-359-00 | 1-108-382-00 | 1-108-426-00 | 0.27 | 1-108-854-00 | – | – |
| 0.0033 | 1-108-232-00 | 1-108-371-00 | 1-108-415-00 | 0.033 | 1-108-244-00 | 1-108-383-00 | 1-108-427-00 | 0.33 | 1-108-855-00 | – | – |
| 0.0039 | 1-108-354-00 | 1-108-372-00 | 1-108-416-00 | 0.039 | 1-108-360-00 | 1-108-384-00 | 1-108-428-00 | 0.39 | 1-108-856-00 | – | – |
| 0.0047 | 1-108-234-00 | 1-108-373-00 | 1-108-417-00 | 0.047 | 1-108-246-00 | 1-108-385-00 | 1-108-429-00 | 0.47 | 1-108-857-00 | – | – |
| 0.0056 | 1-108-355-00 | 1-108-374-00 | 1-108-418-00 | 0.056 | 1-108-361-00 | 1-108-386-00 | 1-108-430-00 | | | | |
| 0.0068 | 1-108-237-00 | 1-108-375-00 | 1-108-419-00 | 0.068 | 1-108-249-00 | 1-108-387-00 | 1-108-431-00 | | | | |
| 0.0082 | 1-108-356-00 | 1-108-376-00 | 1-108-420-00 | 0.082 | 1-108-362-00 | 1-108-388-00 | 1-108-432-00 | | | | |



## TANTALUM CAPACITORS

RATING → : Use the high voltage rated one.

| CAP. (μF) | 3.15 VOLT. | 6.3 VOLT. | 10 VOLT. | 16 VOLT. | 20 VOLT. | 25 VOLT. | 35 VOLT. |
|---|---|---|---|---|---|---|---|
| | PART No. | PART No. | PART No. | PART No. | PART No. | PART No. | PART No. |
| 0.01 | | | | | → | → | 1-131-396-00 |
| 0.015 | | | | | | → | 1-131-397-00 |
| 0.022 | | | | | | → | 1-131-398-00 |
| 0.033 | | | | | | → | 1-131-399-00 |
| 0.047 | | | | | | → | 1-131-400-00 |
| 0.068 | | | | | → | → | 1-131-401-00 |
| 0.1 | | | | | → | → | 1-131-402-00 |
| 0.15 | | | | | → | → | 1-131-403-00 |
| 0.22 | | | | | → | → | 1-131-404-00 |
| 0.33 | | | | | → | 1-131-409-00 | 1-131-405-00 |
| 0.47 | – | – | – | – | 1-131-412-00 | → | 1-131-406-00 |
| 0.68 | – | – | – | 1-131-415-00 | → | 1-131-410-00 | 1-131-407-00 |
| 1.0 | – | – | 1-131-418-00 | – | 1-131-413-00 | → | 1-131-408-00 |
| 1.5 | – | 1-131-421-00 | – | 1-131-416-00 | → | 1-131-411-00 | 1-131-348-00 |
| 2.2 | 1-131-424-00 | – | 1-131-419-00 | – | 1-131-414-00 | 1-131-355-00 | 1-131-349-00 |
| 3.3 | – | 1-131-422-00 | – | 1-131-417-00 | 1-131-362-00 | 1-131-356-00 | 1-131-350-00 |
| 4.7 | 1-131-425-00 | – | 1-131-420-00 | 1-131-369-00 | 1-131-363-00 | 1-131-357-00 | 1-131-351-00 |
| 6.8 | – | 1-131-423-00 | 1-131-376-00 | 1-131-370-00 | 1-131-364-00 | 1-131-358-00 | 1-131-352-00 |
| 10 | 1-131-426-00 | 1-131-383-00 | 1-131-377-00 | 1-131-371-00 | 1-131-365-00 | 1-131-359-00 | 1-131-353-00 |
| 15 | 1-131-390-00 | 1-131-384-00 | 1-131-378-00 | 1-131-372-00 | 1-131-366-00 | 1-131-360-00 | – |
| 22 | 1-131-391-00 | 1-131-385-00 | 1-131-379-00 | 1-131-373-00 | 1-131-367-00 | | |
| 33 | 1-131-392-00 | 1-131-386-00 | 1-131-380-00 | 1-131-374-00 | | | |
| 47 | 1-131-393-00 | 1-131-387-00 | 1-131-381-00 | – | | | |
| 68 | 1-131-394-00 | 1-131-388-00 | – | – | | | |
| 100 | 1-131-395-00 | – | – | – | | | |



## TANTALUM CAPACITORS

RATING

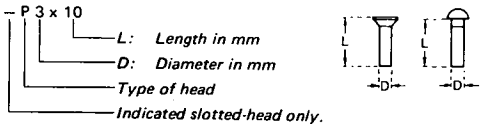
| CAP. (μF) | 3 VOLT. | 6.3 VOLT. | 10 VOLT. | 16 VOLT. | 20 VOLT. | 35 VOLT. |
|---|---|---|---|---|---|---|
| | PART No. | PART No. | PART No. | PART No. | PART No. | PART No. |
| 0.033 | | | | | | 1-131-273-00 |
| 0.047 | | | | | | 1-131-274-00 |
| 0.068 | | | | | | 1-131-275-00 |
| 0.1 | | | | | | 1-131-276-00 |
| 0.15 | | | | | | 1-131-277-00 |
| 0.22 | | | – | – | 1-131-262-00 | 1-131-278-00 |
| 0.33 | | | – | – | 1-131-263-00 | 1-131-279-00 |
| 0.47 | | | 1-131-169-00 | – | 1-131-264-00 | 1-131-280-00 |
| 0.68 | | | – | 1-131-258-00 | 1-131-265-00 | 1-131-281-00 |
| 1.0 | | | 1-131-254-00 | – | 1-131-266-00 | 1-131-282-00 |
| 1.5 | | 1-131-250-00 | – | – | 1-131-267-00 | 1-131-283-00 |
| 2.2 | | – | – | 1-131-259-00 | 1-131-268-00 | 1-131-284-00 |
| 3.3 | | – | 1-131-255-00 | – | 1-131-269-00 | – |
| 4.7 | | 1-131-251-00 | 1-131-171-00 | – | 1-131-270-00 | – |
| 6.8 | | – | – | 1-131-260-00 | 1-131-271-00 | – |
| 10 | – | – | 1-131-256-00 | – | 1-131-272-00 | – |
| 15 | – | 1-131-252-00 | – | 1-131-261-00 | | |
| 22 | – | – | 1-131-257-00 | – | | |
| 33 | 1-131-176-00 | 1-131-253-00 | 1-131-173-00 | – | | |
| 47 | 1-131-288-00 | 1-131-174-00 | – | – | | |
| 100 | 1-131-177-00 | | | | | |

## 1/4 WATT CARBON RESISTORS

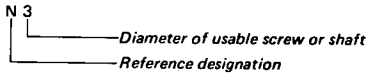
| Ω | Part No. | Ω | Part No. | Ω | Part No. | Ω | Part No. | Ω | Part No. | Ω | Part No. | Ω | Part No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 1-246-401-00 | 10 | 1-246-425-00 | 100 | 1-246-449-00 | 1.0k | 1-246-473-00 | 10k | 1-246-497-00 | 100k | 1-246-521-00 | 1.0M | 1-246-545-00 |
| 1.1 | 1-246-402-00 | 11 | 1-246-426-00 | 110 | 1-246-450-00 | 1.1k | 1-246-474-00 | 11k | 1-246-498-00 | 110k | 1-246-522-00 | 1.1M | 1-210-814-00 |
| 1.2 | 1-246-403-00 | 12 | 1-246-427-00 | 120 | 1-246-451-00 | 1.2k | 1-246-475-00 | 12k | 1-246-499-00 | 120k | 1-246-523-00 | 1.2M | 1-210-815-00 |
| 1.3 | 1-246-404-00 | 13 | 1-246-428-00 | 130 | 1-246-452-00 | 1.3k | 1-246-476-00 | 13k | 1-246-500-00 | 130k | 1-246-524-00 | 1.3M | 1-210-816-00 |
| 1.5 | 1-246-405-00 | 15 | 1-246-429-00 | 150 | 1-246-453-00 | 1.5k | 1-246-477-00 | 15k | 1-246-501-00 | 150k | 1-246-525-00 | 1.5M | 1-210-817-00 |
| 1.6 | 1-246-406-00 | 16 | 1-246-430-00 | 160 | 1-246-454-00 | 1.6k | 1-246-478-00 | 16k | 1-246-502-00 | 160k | 1-246-526-00 | 1.6M | 1-210-818-00 |
| 1.8 | 1-246-407-00 | 18 | 1-246-431-00 | 180 | 1-246-455-00 | 1.8k | 1-246-479-00 | 18k | 1-246-503-00 | 180k | 1-246-527-00 | 1.8M | 1-210-819-00 |
| 2.0 | 1-246-408-00 | 20 | 1-246-432-00 | 200 | 1-246-456-00 | 2.0k | 1-246-480-00 | 20k | 1-246-504-00 | 200k | 1-246-528-00 | 2.0M | 1-210-820-00 |
| 2.2 | 1-246-409-00 | 22 | 1-246-433-00 | 220 | 1-246-457-00 | 2.2k | 1-246-481-00 | 22k | 1-246-505-00 | 220k | 1-246-529-00 | 2.2M | 1-210-821-00 |
| 2.4 | 1-246-410-00 | 24 | 1-246-434-00 | 240 | 1-246-458-00 | 2.4k | 1-246-482-00 | 24k | 1-246-506-00 | 240k | 1-246-530-00 | 2.4M | 1-244-754-00 |
| 2.7 | 1-246-411-00 | 27 | 1-246-435-00 | 270 | 1-246-459-00 | 2.7k | 1-246-483-00 | 27k | 1-246-507-00 | 270k | 1-246-531-00 | 2.7M | 1-244-755-00 |
| 3.0 | 1-246-412-00 | 30 | 1-246-436-00 | 300 | 1-246-460-00 | 3.0k | 1-246-484-00 | 30k | 1-246-508-00 | 300k | 1-246-532-00 | 3.0M | 1-244-756-00 |
| 3.3 | 1-246-413-00 | 33 | 1-246-437-00 | 330 | 1-246-461-00 | 3.3k | 1-246-485-00 | 33k | 1-246-509-00 | 330k | 1-246-533-00 | 3.3M | 1-244-757-00 |
| 3.6 | 1-246-414-00 | 36 | 1-246-438-00 | 360 | 1-246-462-00 | 3.6k | 1-246-486-00 | 36k | 1-246-510-00 | 360k | 1-246-534-00 | 3.6M | 1-244-758-00 |
| 3.9 | 1-246-415-00 | 39 | 1-246-439-00 | 390 | 1-246-463-00 | 3.9k | 1-246-487-00 | 39k | 1-246-511-00 | 390k | 1-246-535-00 | 3.9M | 1-244-759-00 |
| 4.3 | 1-246-416-00 | 43 | 1-246-440-00 | 430 | 1-246-464-00 | 4.3k | 1-246-488-00 | 43k | 1-246-512-00 | 430k | 1-246-536-00 | 4.3M | 1-244-760-00 |
| 4.7 | 1-246-417-00 | 47 | 1-246-441-00 | 470 | 1-246-465-00 | 4.7k | 1-246-489-00 | 47k | 1-246-513-00 | 470k | 1-246-537-00 | 4.7M | 1-244-761-00 |
| 5.1 | 1-246-418-00 | 51 | 1-246-442-00 | 510 | 1-246-466-00 | 5.1k | 1-246-490-00 | 51k | 1-246-514-00 | 510k | 1-246-538-00 | 5.1M | 1-244-762-00 |
| 5.6 | 1-246-419-00 | 56 | 1-246-443-00 | 560 | 1-246-467-00 | 5.6k | 1-246-491-00 | 56k | 1-246-515-00 | 560k | 1-246-539-00 | | |
| 6.2 | 1-246-420-00 | 62 | 1-246-444-00 | 620 | 1-246-468-00 | 6.2k | 1-246-492-00 | 62k | 1-246-516-00 | 620k | 1-246-540-00 | | |
| 6.8 | 1-246-421-00 | 68 | 1-246-445-00 | 680 | 1-246-469-00 | 6.8k | 1-246-493-00 | 68k | 1-246-517-00 | 680k | 1-246-541-00 | | |
| 7.5 | 1-246-422-00 | 75 | 1-246-446-00 | 750 | 1-246-470-00 | 7.5k | 1-246-494-00 | 75k | 1-246-518-00 | 750k | 1-246-542-00 | | |
| 8.2 | 1-246-423-00 | 82 | 1-246-447-00 | 820 | 1-246-471-00 | 8.2k | 1-246-495-00 | 82k | 1-246-519-00 | 820k | 1-246-543-00 | | |
| 9.1 | 1-246-424-00 | 91 | 1-246-448-00 | 910 | 1-246-472-00 | 9.1k | 1-246-496-00 | 91k | 1-246-520-00 | 910k | 1-246-544-00 | | |

## HARDWARE NOMENCLATURE

**Screw:**




**Nut, Washer, Retaining ring:**




| Reference Designation | Shape | Description | Remarks |
|---|---|---|---|
| **SCREWS** | | | |
| P | | pan-head screw | binding-head (B) screw for replacement |
| PWH | | pan-head screw with washer face | binding-head (B) screw and flat washer for replacement |
| PS<br>PSP | | pan-head screw with spring washer | binding-head (B) screw and spring washer for replacement |
| PSW<br>PSPW | | pan-head screw with spring and flat washers | binding-head (B) screw and spring and flat washers for replacement |
| R | | round-head screw | binding-head (B) screw for replacement |
| K | | flat-countersunk-head screw | |
| RK | | oval-countersunk-head screw | |
| B | | binding-head screw | |
| T | | truss-head screw | binding-head (B) screw for replacement |
| F | | flat-fillister-head screw | |
| RF | | fillister-head screw | |
| BV | | braizer-head screw | |

| Reference Designation | Shape | Description | Remarks |
|---|---|---|---|
| **SELF-TAPPING SCREWS** | | | |
| TA | | self-tapping screw | ex: TA, P 3 x 10 |
| PTP | | pan-head self-tapping screw | binding-head self-tapping (TA, B) screw for replacement |
| PTPWH | | pan-head self-tapping screw with washer face | binding-head self tapping (TA, B) screw and flat washer for replacement |
| PTTWH | | pan-head thread-rolling screw with washer face | binding-head (B) screw and flat washer for replacement |
| **SET SCREWS** | | | |
| SC | | set screw | |
| SC | | hexagon-socket set screw | ex: SC 2.6 x 4, hexagon socket |
| **NUT** | | | |
| N | | nut | |
| **WASHERS** | | | |
| W | | flat washer | |
| SW | | spring washer | |
| LW | | internal-tooth lock washer | ex: LW3, internal |
| LW | | external-tooth lock washer | ex: LW3, external |
| **RETAINING RINGS** | | | |
| E | | retaining ring | |
| G | | grip-type retaining ring | |

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